CHEMICAL & METALLURGICAL ENGINEERING

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW, *President*
E. J. MEHREN, *Vice-President*

H. C. PARMELEE
Editor

Volume 33 — New York, June, 1926 — Number 6

First Aid to Intelligent Legislation

PROPOSING a halt on further regulatory legislation until an industrial survey of the state could be made by the New York legislature, a group of manufacturers so impressed the law makers with the wisdom of their suggestion that a commission is to be appointed to study every phase of the industrial situation that confronts New York and her industries. The activity grew out of a feeling on the part of manufacturers that the legislature now proceeds blindly to pass bills affecting industrial prosperity without knowing precisely whether the ultimate effect will be good or bad.

THE proposed survey is not directed toward ascertaining the material resources of the state; that is the function of other agencies. It will be concerned with such problems as taxation and its effect on the growth of industry. It will investigate the merits of reform measures often sponsored by ill-informed minorities, which work havoc in greater measure than the good they are designed to accomplish. It will look into the status of agriculture, its relation to manufacturing industry, and the bearing of conditions in both lines of activity on the cost of living. It will delve into the relation of industrial production to popular needs, revealing logical lines of expansion and contraction. Unemployment, housing and the welfare of the worker will come within its scope.

OBVIOUSLY the hope of those who have sponsored this survey is that, with facts at its command, the legislature will deal more intelligently with measures affecting industry. General welfare—of the worker, of the investor, of the manufacturer, of the state—is the object sought. Special interest is put aside, and the legislature is asked to inform itself of the facts so that all will be treated fairly.

SUCH a survey may well commend itself to organized industry in other states. If other legislative leaders are as representative of their constituents and as responsive to their desires as those of New York proved to be, they will welcome the suggestion of a survey and appreciate the spirit in which it is made. Legislators are too often the targets of propaganda and agitation from numerous groups with selfish interests, and they will doubtless be relieved to see business men giving attention in advance of legislation to matters of fundamental importance.

SINCE chemical engineering industries are frequently the object of ill-advised legislation they may properly take the lead in this direction. Restrictive measures against them as to location, development, alleged nuisance, health and safety, insurance, compensation, inspection and taxation, may be agitated without good reason by well meaning propagandists. The result may be an aggregation of burdens so great as to drive some forms of manufacture out of business. Reform may have its temporary success, but only at the expense of the general prosperity of the state. The best preventive is knowledge of the facts, and the legislature which informs itself in advance will more nearly approach the standards of wisdom and justice in legislation on the industries within its jurisdiction.

Technical Audits for Economy and Efficiency

IT IS an old story that industrial executives are likely to lose contact with the details and refinements of operation; that routine duties may absorb their time to the exclusion of constructive effort; that policies and methods once established can persist too long; that lines of least resistance are easily followed; that traditions often develop that weaken rather than strengthen an organization. Particularly in the day of prosperity are these elements of *laissez faire* likely to become fixed. Usually it is only when adversity comes that a searching analysis for economy and efficiency is made with respect to management and production.

Discussing these things recently with a mature chemical engineer who has been active in organization and production work for a number of years and who has had an opportunity to observe good and bad administration, he outlined a policy that would afford a periodical check on the details of operation and eliminate numerous leaks and losses which aggregate a large sum. Briefly it amounts to a technical audit by an outside engineer of a company's operations with a view to cutting costs in operating practice, labor, power and raw materials. The analogy to a financial audit by a public accountant is at once evident and pertinent, but with this difference: That the technical auditor should detect undesirable trends and correct bad practice before disaster arrives, save many times his cost and increase profits.

Considering the character of their training, chemical engineers should be well equipped for such service. Obviously they should also have had diversified production experience, the broader the better, though it need not necessarily be in the particular line of industry investigated. Such an infusion of outside blood, even temporarily, should result in detecting wastes and losses not evident to the man on the job. It may even be of advantage to the investigator to be untrammeled by a knowledge of the customs and traditions of the plant. Men who are close to their work day in and day out are apt to become dull and lose imagination. To the younger recruits they pass on their prejudices and opinions; and these apprentices, lacking broad experience, fall into the habits of their elders and perpetuate bad practice with the good.

The technical audit looks like a good tool for increasing industrial efficiency. The auditor should represent the high officials of the company and be responsible solely to them. He should be welcomed by subordinates as a constructive helper. Whatever his salary, he should prove a profitable investment and not a net expense. In the interest of better chemical engineering in industry *Chem. & Met.* bespeaks a recognition of the technical auditor and a more general use of such service.

Engineers and Not Journalists

AN ERSTWHILE CONTRIBUTOR writes to explain his ominous silence during the past few months. Shortly after he had submitted his last manuscript to *Chem. & Met.*, but before it was published, he changed positions, entering the employ of a certain large corporation that has an unenviable reputation for muzzling its technical men. In due course the article appeared over our contributor's signature but with an address that inadvertently referred to his new connection. What followed is best described in his own words: "One of the crowned heads of the corporation, who happened to see my article in *Chem. & Met.*, called in the superintendent and told him he was supposed to be employing engineers and not journalists. He was only pacified when I finally convinced him that the article was written and submitted before I came to ———. Thus I have learned my lesson and although I occasionally have ideas that might pass muster with *Chem. & Met.*, they are, for the present at least, effectively bottled up."

This is a regrettable commentary on a situation that, fortunately for all concerned, is fast disappearing from the chemical engineering industries.

Comparative Costs and Interest Charges

A SUBJECT of frequent debate among plant executives and cost accountants is whether or not interest on invested capital should be included as a part of production expense. The question is a vital one, as it affects prices and profits. So many plausible arguments have been advanced pro and con that a summary of sound procedure in this phase of cost accounting seems to be in order.

At the outset it can be said that a purely arbitrary ruling is impossible. Each item of capital assets should be considered separately and also in relation to corresponding assets in the properties of competitors. Proceeding on this plan, a rational analysis of capital assets should be made and this analysis will form the basis of policy as to the inclusion of interest.

Examining a typical cost statement we find that interest is of two kinds:

1. Interest actually paid out, as on bank loans, notes and the like.

2. Interest not actually paid out, as on real estate, equipment, raw materials and cash. With regard to interest on obligations, there is no choice. As such, it is charged to the profit and loss account, which is a part of administrative, and not of factory cost.

Proceeding now to a consideration of various assets of the second class, it is reasonable to charge interest in the following instances:

1. On real estate, because the equity of competitors in such property varies from nothing (in the case of rented property) to full ownership.

2. On plant equipment, because even within a given industry, equipment varies widely. For example, one plant may have a small investment in material handling equipment, relying mainly on manual labor for this work; whereas another plant may have displaced such labor nearly wholly with machinery, and in order to place the two cost statements on an equal basis, interest on the equipment should be included.

3. On stored materials in excess of normal requirements. Such materials generally are bought with the hope of realizing speculative profits, appreciation of value while in stock, or in anticipation of a shortage.

4. On products undergoing prolonged ageing while in stock. Obviously, this is normally a carrying charge; but when such ageing is essential to quality of product in a particular process, it is a legitimate manufacturing expense.

By the same criterion, interest should not be charged:

1. On work in process, unless the length of the process cycle varies widely from plant to plant, as in par. (4) above.

2. On current assets such as cash and accounts receivable, as the order of relative magnitude of these is the same over a long period of time for all competitors.

On the basis of the foregoing, the following general rule can be recommended: Interest on invested capital should be included whenever an asset is likely to be non-uniform as to type and magnitude within a given industry. Only by recognizing such a rule can true comparative costs be obtained and competitive conditions stabilized in an industry that has no specified uniform cost system.

Replacing Men With Automatic Control Devices

CHEMICAL engineering practice varies among different industries even though the same fundamental operations are involved. It varies from one branch of an industry to another and oftentimes from one section of the country to another. A case in point is the wide use of automatic control in the Mid Continent petroleum industry as contrasted with less advanced practice in the older refineries of the East.

Doubtless a combination of circumstances is responsible for this difference in the development of the industry in the two localities. One plausible reason, however, is that when automatic control devices were first introduced in the eastern refineries, they were in a crude state of development and many failed disastrously simply because of mechanical shortcomings that were later eliminated as experience was gained in their manufacture and use.

But when the Mid Continent industry developed a good many years later, circumstances were considerably different. Skilled labor was not easily attracted to the new country although many technical men were already there, carrying on the pioneer work of establishing the new industry. Furthermore, automatic control devices were no longer in the experimental stages, but had been perfected mechanically and had demonstrated their worth in other industries. The new refineries were built to take advantage of modern methods and equipment—to turn out the maximum of product with the minimum of labor and supervision. Automatic control fitted in naturally with such a production scheme and soon became an integral part of operations.

Elsewhere in this issue a staff article describes a natural gasoline plant that may be regarded as typical of the scores of modern plants to be found in the Mid Continent oilfields. The fundamental processes involved—compression, absorption and distillation—lend themselves to continuous operations that can best be systematized into a normal sequence by the use of automatically controlled equipment. To remove the gasoline content from 1,500,000 cu.ft. of rich casinghead gas per day and to refine the recovered product to exacting market specifications, might conceivably require 30 operators assuming that only batch operations were used with manual control left largely to the judgment of the workman. Instead, the wide use of automatic control equipment in this plant makes it possible for two process men to carry on routine production with a minimum of technical supervision.

There are many of our industries that can take a leaf from the natural gasoline manufacturer's book of experience. Replacing men with automatic control devices will not only simplify an industry but may greatly increase its production efficiency.

The Importance Of Being Thorough

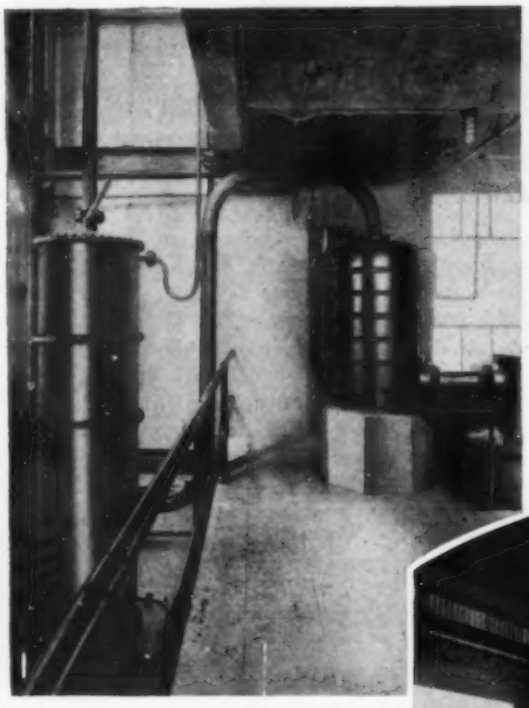
LABOR-SAVING devices such as material handling equipment and automatic machinery have been highly developed and their use has been widely extended during the past decade. Industries that until recently placed large dependence on hand labor, both for productive and non-productive work, are now equipped to operate with this labor reduced to a minimum. Where machines have taken the place of men, so many economies and other advantages have been realized that there is now a well-defined tendency in almost all industries to adopt these improvements.

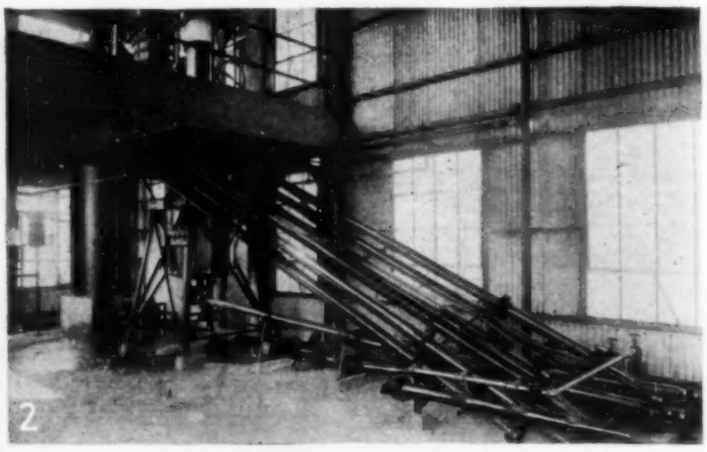
It is only natural that, in a movement so large, some of the participants should not thoroughly understand what they are doing, but should be like the ignorant voter who climbs into a political bandwagon though he may have no understanding of the issues of the campaign. The adoption of labor-saving equipment, in order that full and permanent advantage may result, must be the outcome of a well co-ordinated plan that takes into account every phase of the business. When it is not so based, the plant may find itself no better off from a manufacturing standpoint and, in addition, be saddled with the fixed charges on a greatly increased investment in equipment.

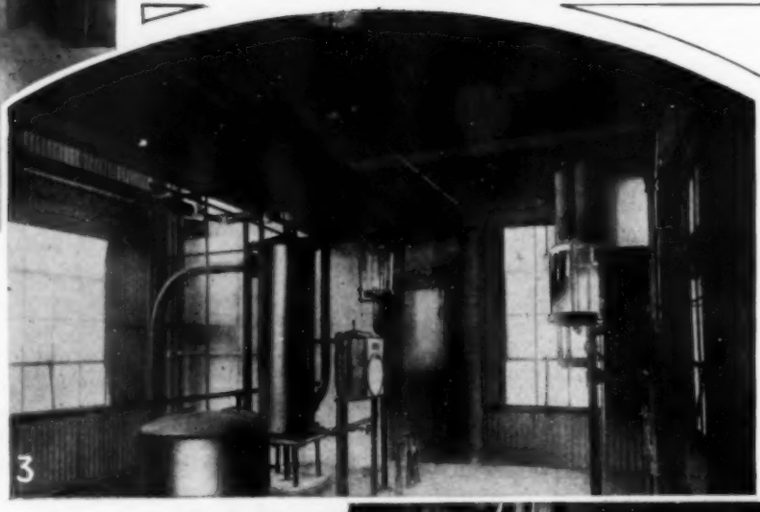
An example of this has recently come to light in the case of a plant built by a large manufacturing company. The management, having heard much of labor-saving equipment in their industry, decided that the new plant should embody as many such aids as could be used. They decided, however, that the process which was the real focal point of their manufacturing procedure would have to continue as a fully manual process, because no equipment was available that could properly supersede hand labor in this operation. Elsewhere in the plant a full quota of automatic production and conveying equipment was installed.

After the plant was completed and operation commenced it was found that the one manual operation remaining had become the pacemaker of the whole process. It was not possible to speed up this hand labor except by employing more men and greatly increasing the labor charges. On the other hand, unless this were done, the overhead due to the investment in modern equipment was inordinately high. Consequently, they found themselves in a disadvantageous position as compared to their competitors.

This condition would never have occurred if a sufficiently thorough study of the process had been carried out before any investment was made in new equipment. Certain improvements could profitably have been adopted but the full mechanization of the process should have awaited the perfection of equipment to take the place of the one manual operation. How much better it would have been if this company, instead of thinking that they could go ahead safely by copying what they thought their competitors had done, had employed competent engineering counsel and carried through the improvements in a true engineering way.







Random Views in an Alcohol-Ether Plant in Cuba

1. Scrubber and rectifying column for ether purification.

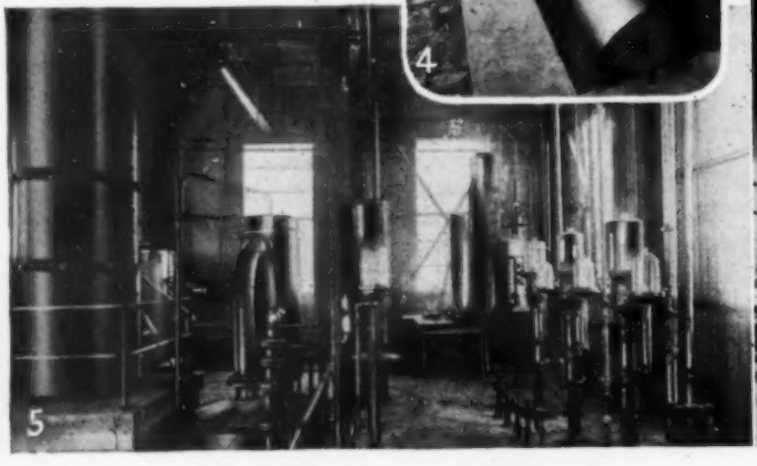
2. Ether generator. The inclined pipes are heating units. At left and on the mezzanine floor is the ether equipment shown in Fig. 1.

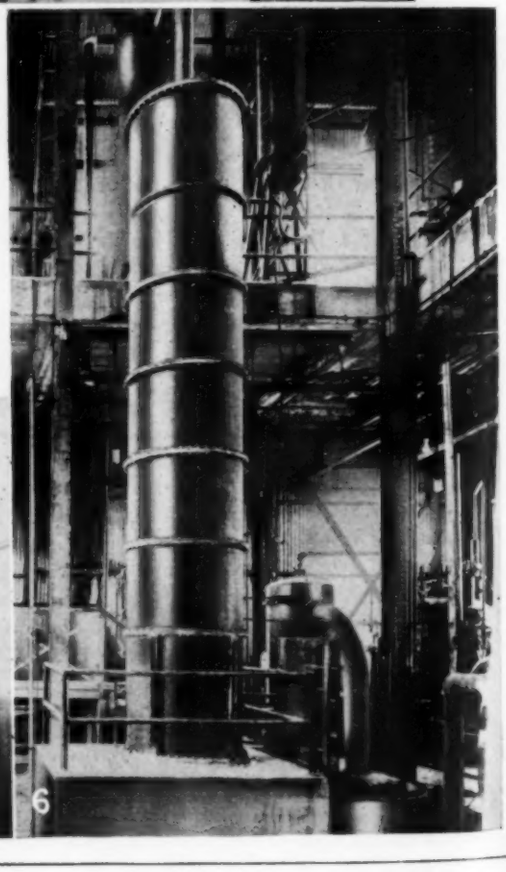
3. Control floor in ether plant. At right is the alcohol control gage. At left, the denaturing mixer, reflux, Bailey gravity recorder and product gage for alcohol-ether mixture.

4. Acid egg outside of ether building.

5. Control floor in the alcohol fermentation plant.

6. Alcohol rectifying column.





Making Alcohol-Ether Mixture in Cuba for Motor Fuel

How a plant was designed and constructed for the fermentation of waste molasses in order to take advantage of peculiar economic as well as climatic conditions in the Tropics

By E. Humboldt
Former manager, Preston (Cuba) plant, United Fruit Co.
Consulting Engineer, West Everett, Mass.

THERE is nothing new about the use of alcohol and alcoholic mixtures for power purposes: it is done on a large scale in South Africa, in some of the West Indies and in Europe. As a matter of fact, the only governing factor is the price at which it can be marketed as compared with other motor fuels. Naturally, when one has to pay from 30c. to 40c. a gallon for gasoline while there is an abundance of raw material to be used for the manufacture of alcoholic motor fuels, it seems reasonable to develop this latter industry for the purpose of obtaining a dependable supply at much lower cost.

It is well known that alcohol alone is not an entirely satisfactory fuel for the average automobile or tractor engine without some important changes: in other words it is not interchangeable with gasoline. The addition of benzol and various other hydrocarbons obviates this difficulty, but it increases the cost of the product and, besides, the world production of benzol is far from being adequate to supply the demand for such purposes. However, the addition of ordinary ether to alcohol in the proportion of from 20 to 35 per cent, according to conditions, produces a fuel which is eminently satisfactory as regards power production, ease of starting and economy. Ether is made from alcohol in a very simple way and at a slight additional cost and its supply is comparable to that of alcohol; consequently the manufacture of fuel from alcohol and ether can be made independent of outside conditions if a good supply of raw material for fermentation is assured.

In the sequence of operations, from the fermentation of the saccharine mass to the blending of the finished fuel, the etherification of alcohol is an important step; but it is not at all necessary to manufacture pure ether as such. Pure ether has a low boiling point and its complete recovery by condensation is a difficult problem in a tropical climate where the cooling water is often more or less tepid. But since it is going to be used as a mixture, there is no reason for a separation; consequently the alcohol-ether-water mixture issuing from the ether generator is simply freed from water in a small rectifying column, the product passing over is condensed, and the escaping vapors absorbed in a scrubber. The product issuing from that scrubber is mixed with the main condensate and its amount properly regulated so as to obtain a mixture of the proper concentration.

If you have to pay a high price for gasoline, are a large consumer and have on hand an abundant supply of cheap waste saccharine matter, then the conditions are excessively favorable for a start in the manufacture and use of alcoholic motor fuel: such was the case in Cuba a few years ago. The Cuban government had put a heavy import tax on gasoline which, together with the freight and cost of distribution brought up the retail price to about 35c.–37c. per gallon with delivery to out-of-way points more or less uncertain. The United Fruit Co., operating two of the largest sugar centrals in Cuba, near Antilla (at Boston and Preston), was an enormous user of gasoline for tractor, truck, motor boat and railroad car work; the immediate neighborhood offered a good field for the distribution of whatever surplus they might accumulate. The company had a good supply of waste molasses which commanded at best a low price on the open market: from 2c. to 2½c. a gallon; and after long and thoughtful inquiries decided to enter the motor fuel field.

The plant, which was furnished by the Walter E. Lummus Co., of Boston, was erected during the summer of 1924 and production started in the late fall. The steam plant, two 1,000,000-gal. tanks (one for water and one for molasses storage), and the buildings were furnished by the United Fruit Co.; while the Lummus company supplied the patented process, the molasses mashing and handling equipment, the fermentation tanks, distilling apparatus, complete ether plant, storage tanks for the finished product, and all the various pumps and auxiliary devices as well as the architect's plans for the buildings. They also superintended the construction work.

The plant was designed according to the best modern practice from the point of view of labor saving, safety and ease of operation, so that the process of manufacturing is nearly automatic and continuous. As a result, the supervision is rendered simple yet every step can be controlled as desired.

Pumping and "Mashing" Molasses

Waste molasses is pumped from the mill through an 8-in. line into a storage tank of 1,000,000 gal. capacity, of standard steel construction, completely covered and laid on a sand foundation finished on the outside with a heavy concrete ring which would prevent any washing out during the rainy season. Incidentally, that ring serves also another purpose: land crabs are plentiful in that vicinity and have a fashion of digging holes entirely out of proportion with the size of their claws, so that a few of them will soon undermine almost anything if allowed to proceed with their work. The concrete ring being sunk in the ground some 18–20 in. is sufficient to discourage their efforts and to prevent them from doing any excavating under the tank. The water storage, which is of the same capacity is also laid in the same way.

Another pipe line leads from the mill to the shipping

tanks at the wharf; and the pumps which are used in loading tankers are so arranged that molasses can be sent back through the mill to the alcohol plant whenever desired.

The mashing installation, which is in duplicate, is located close to the molasses storage and consists of Kinney pumps for the molasses and steam-driven reciprocating pumps for the water. The molasses and water pumps work against one another so as to give complete mixing. A double strainer of large capacity placed on the molasses suction removes all coarse foreign substances which might injure the pumps or disturb their working, and a small steam jet is used to warm up the molasses from the storage tank. The waste molasses is at times very heavy and viscous, reaching up to 96 deg. Brix for days at a time. As a consequence no pump could handle the product at ordinary temperature, even in the Tropics.

A continuous sample of the mixture shows at all times its specific gravity and affords sufficient information to guide the pump operator who, by a slight change in the speed of either pump can keep a constant flow of a mixture of any desired composition.

A standard pneumercator attached to the molasses storage gives the amount used, and the same service is performed for the water consumption by a meter placed on the main leading to the water pumps.

Conducting Fermentation Process

Fermentation takes place in 4 steel tanks of approximately 70,000 gal. capacity, completely closed and provided with the usual fittings, pumping lines, gas outlets and top and bottom manholes. They are built on a solid concrete foundation and surrounded by gutters which carry all waste to the sewer system. The only housing is a roof: the walls have been omitted for the sake of ventilation and cooling as there is no particular device installed for that purpose on account of the scanty water supply during the hot, dry season. However, there has not been any great difficulty in obtaining good fermentations, although the temperature will at times climb up to 90 deg. F. The temperature in the interior of the fermenting mass is indicated by thermometers and for reference purposes entered in the records, as well as the time of filling, emptying and the alcoholic contents. Generally, from 18 to 20 hours are necessary to have a clean and complete fermentation; and as much time as possible is allowed for settling so as to minimize the losses incidental to the washing out of the yeast and mud accumulated in the bottom of the tanks. Moreover, this settling decreases the amount of solids carried to the still and the incrustations, as well.

The fermented liquid being kept in a covered tank capped by a layer of carbonic acid will keep for several days without any appreciable loss from evaporation or souring. The yeast used in the fermentations is first grown from pure cultures in a Magne pure yeast machine located on the control floor of the distillery where it can receive the proper amount of attention. It is then grown on a larger scale in two yeast tanks holding approximately 3,000 gal. each, and which are also placed on the same control floor. The yeast raised from the pure cultures and developed in the two larger tanks is extremely vigorous, ferments quickly and rapidly, will stand a fairly high temperature and is renewed at each operation.

The distilling equipment consists of a standard Lummus type double-column beer and rectifying still with a daily capacity of about 3,000 gal. of 96 per cent alcohol. It is designed for continuous operation and is equipped with beer heater, pressure regulator, tail tester and all the various controls adopted in modern practice. A smaller periodic still is provided with rectifying column and suitable condensers adapted for the rectification of fusel oil or of any weak spirits that may accumulate from time to time. A storage and distributing tank for the fermented mash or "beer" going to the continuous still, a series of storage tanks for the various grades of alcohol and the many pumps needed to handle the beer and the alcohol complete the distillation equipment. These last accessories are in duplicate so as to avoid a shut-down when any repairs are necessary.

All of the controls—alcohol testers, fusel oil washer, pressure regulator, beer feed regulator, and the valves controlling the water admission to the various condensers—have been brought together on the third floor so that the operator does not have to travel from one place to another but can give all his attention to the work at hand.

Control of Distillation

Thermometers give the temperature at the most important points of the system and afford an accurate indication of the process. To one thoroughly familiar with the operation, they are better guides than the alcoholometers at the product gages because their indications are in advance of the condensing system. By paying strict attention to the variation of temperature at the various refluxes and at the point where the strong alcohol is extracted in the liquid phase, one can run more efficiently and with a greater uniformity than by depending on the concentration of the products. Still, these latter indications are not to be despised as thermometers have, at times, a peculiar way of getting out of adjustment.

The still operation is greatly facilitated by an appliance giving a constant head to the beer being fed in; this consists simply of a small tank fed from the main storage through a pipe equipped with a float valve which will maintain a constant level so long as the draft is not greater than the supply. The pressure regulator, balancing as it does the internal pressure of the column and holding it at any desired point, insures a steady heat interchange from chamber to chamber. This means a constant water and alcohol composition at any particular place during the work, and consequently as soon as the amount of alcohol withdrawn as heads and as pure alcohol is kept steady and equal to the input through the beer feed, the operation of the still will be uniformly controlled. The fusel oil must also be withdrawn in exactly the same way because if allowed to accumulate in any quantity it will find its way either upward or downward and upset the working equilibrium in spite of all possible care to keep everything else running smoothly.

The tail tester is a well-known device: vapor from the still bottom is led upward to a small coil condenser and the condensate passes continuously through a hydrometer carrying a sensitive alcoholometer of low reading. The percentage of alcohol in the vapor is much higher than that in the liquid being boiled in the bottom chamber, and as long as the percentage as read at the tester is low one can be sure that the amount

of alcohol in the slop going to the sewer is negligible: at most a few hundredths of one per cent.

In the manufacture of alcohol for fuel it is generally best to operate at the highest possible concentration, and for that reason the output of the still is separated into two grades which are kept separate throughout the whole process, each one being of a good uniform concentration. This helps maintain constant operating conditions and also greatly facilitates the bookkeeping.

The storage tanks for alcohol, located on the second floor of the building, are connected to the pumps from the bottom for pumping out; but they are filled from the top, the liquid running into them by gravity from the product gages. From that storage it is pumped as needed to a series of smaller tanks located on the top floor and serving as measuring devices and supply storage for the fuel plant proper. The piping to and from the pumps has been grouped into a suction and a discharge manifold which can be connected if desired; and in this way either grade of alcohol and even the fusel oil may be moved at will as needed from one part of the plant to the other. All tanks are vented together through a continuous piping which is connected with the condensing system, and as a result the losses through evaporation are kept down to a minimum.

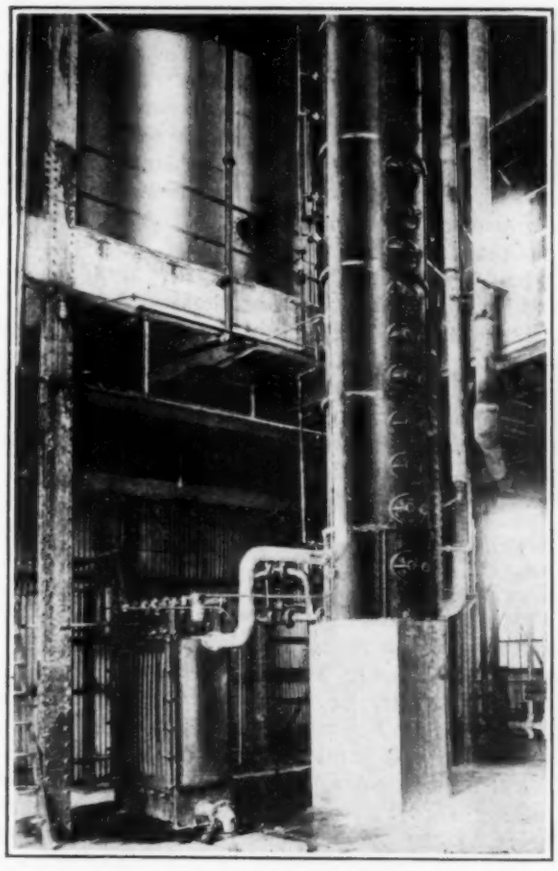
Making Motor Fuel Ether

Alcohol cannot be used alone as fuel in the ordinary internal combustion motor on account of its low vapor tension unless some important changes are made in the carburetting system. Moreover, a much higher initial compression than is generally used would be necessary for efficient running. But, if we add to it a sufficient percentage of ether the vapor tension of the mixture at ordinary temperatures increases rapidly, so that it will form explosive mixtures with air. Even as low a percentage as 15 per cent is sufficient in a hot country.

Moreover, since ether is produced by the withdrawal of one molecule of water from two molecules of alcohol, the available heat of combustion of the alcohol-ether mixture is higher than that of alcohol alone. Accordingly, one recovers as available energy a part of the heat consumed in the ether production.

Ether is made from strong alcohol by dehydration with concentrated sulphuric acid briefly as follows: A molecular mixture of alcohol and acid is heated to a temperature varying from 125 to 135 deg. C., while a steady stream of alcohol is fed into the mixture. Ether distils over mixed with an excess of water vapor and some of the alcohol which has escaped dehydration. This last is not, in a way, undesirable, since more must be added ultimately, although the water vapor must be eliminated as much as possible. This is done in a small column of the ordinary type provided with the usual controls and a reflux condenser followed by a final condenser which delivers a cooled mixture rich in ether. The vapors and non-condensible gases are thoroughly scrubbed to avoid any loss and the necessary amount of alcohol is added to produce a mixture of the required strength.

The ether generator at the Cuban plant departs somewhat from the conventional type by having its heating elements outside the generator itself; this facilitates replacements and repairs whenever necessary. And in spite of all the care given the equipment the acid mixture working at a high temperature is bound to corrode the container which is made of mild steel plate lined with sheet lead. By paying strict attention to the temperature control and to the concentration of the alcohol used in the ether production, it is possible to minimize this corrosion and the dilution of the acid mixture as well. However, eventually this last becomes weaker through dilution and through partial destruction of the acid, and it must be either changed or enriched up to standard.



Double-column Beer Still for 96 per Cent Alcohol

This still, designed for continuous operation, has a daily capacity of about 3,000 gal. It is equipped with beer heater, pressure regulator, tail tester and the latest automatic control devices

For the final dilution of the fuel mixture, ordinary impure alcohol can very well be used, provided it is neutral, since the aldehydes and esters have a good fuel value.

The mixing is done by a special patented type of equipment which is entirely automatic in operation and which also adds the denaturing material required by the Cuban Government; it includes a gravity recorder and a meter which shows at a glance the amount produced. It is so constructed that a mixture of almost any desired ether content can be produced steadily.

Storing and Packing

The storage facilities consist of 4 steel tanks, each of about 4,000 gal. capacity, housed in a separate building made of concrete and corrugated sheet steel, equipped also with a sprinkler system for fire protection. The tanks are located on a platform of some 3 ft. in height for ease in packing and drum filling. All are connected to a 3-in. steel main through individual valves and to a filter near the filling scale. The finished fuel comes from the fuel plant by gravity through a 3-in. line.

The containers used for shipping are the standard 55- and 110-gal. steel drums; the larger size is rather

unwieldy and hard to handle in out-of-way places and their use is practically limited to a few customers owning storage tanks favorably situated. Drums are regularly filled to 50- and 100-gal., leaving room for expansion and for vapor space; the amount put in is weighed on a scale, marked on the drum head in kilograms, reported to the Cuban Government in liters, and finally sold in gallons, being reported in the same units on the plant books.

It had been thought that a market could be found for smaller containers such as the common 5-gal. can, but the additional cost of container, case and filling is too high for the ordinary trade. There might, however, be some demand for a returnable container of smaller size than the 50-gal.; either 20- or 25-gal. drums built to withstand rough handling and billed at a slight additional cost over the larger sizes might prove to be popular with the small consumer.

Economics of Motor Spirit Manufacture

Since motor spirit is a manufactured product its cost depends on the value of raw material and also on the magnitude of the manufacturing operations. It can only take the place of petroleum derivatives when they are the most costly, or when a dependable supply cannot be procured. The most obvious source of raw material for motor-spirit manufacture is the modern sugar mill, which turns out a large amount of waste molasses containing about 50 per cent of fermentable sugars. Occasionally molasses commands a fair market price; but there are times when it is practically impossible to sell and any desired supply can be had for 2c.–3c. per gal. Even when prices are fairly high, there are always some mills which are not adequately equipped for shipping and their output can be had at a reasonable price. And 3c. a gallon for molasses means about 9–10c. as cost of raw material per gallon of finished spirit to which the manufacturing and selling costs must naturally be added.

Another source of saccharine material is the cane itself: it sometimes happens that at the end of the grinding season the purity of the juice drops so that sugar making is no longer profitable. This is generally due to a new start of the growth or to an excess of moisture producing an increase in the glucose contents at the expense of the sucrose. Such juice is eminently suitable for the manufacture of alcohol without defecation or any other treatment whatever; given the proper installation, it would be an easy matter to utilize part of the mill crushing plant and to convey the juice immediately to the distillery. That juice would not keep very long, but it is certainly much cheaper to store alcohol or motor fuel than to store the juice, either dilute or concentrated. In storing juice some antiseptics would have to be added for safe keeping, which must be eliminated before fermentation.

The use of starchy material such as cassava, yams, and sweet potatoes, has also been favorably reported upon, fermentation being produced with the aid of mucors or with common yeast after saccharification. As this is being written, a large project is being started in Australia for the manufacture of motor spirit, using waste cane molasses, waste cane and also the starch from cassava.

The next thing necessary to success in a motor-spirit venture is the possession of a storage capacity ample for all needs, and commensurate with the daily production. To run economically, industrial plants must be operated as near as possible to full capacity; else the overhead and labor costs will soon eat up the profits. Naturally there are times when the selling is somewhat slack, such as bad weather or a pause in cultivation will easily cause; then, suddenly all hands are kept busy shipping and filling orders. If, for lack of sufficient storage, the plant must mark time behind the shipping department, then no progress is possible.

Ordinary steel tanks closed tightly and able to withstand the vapor pressure of the alcohol-ether mixture at the summer temperature are most satisfactory; although, when possible, the tanks should be located under ground to minimize fire hazards. A series of tanks so placed and so connected by steel piping that they can either be connected together or separated at will for filling or pumping out would prove very convenient.

There must also be a good supply of shipping containers. In Cuba, and in the tropics generally, where traffic is slow, a liberal allowance must be made as to the time necessary to unload a shipment and to return the empties. Of course, all standard steel containers, I.C.C. inspected, should be charged to the purchaser of motor fuel and billed with the contents; if they are returned in good order within a reasonable length of time, according to local conditions, they are credited in full. It is the only way to keep track of containers and to insure their return or a compensation for their loss.

If a safe and cool place is provided for that purpose, steel drums can easily be used for storage; they can be bunged tightly after filling and tiered two or three high with a free passage way between piles so as to allow of easy inspection and stock taking. They should preferably be piled with the bung on top because the small vapor leaks that may develop are not nearly as bad as the same volume of liquid leakage when the bung is turned under.

Naturally, all the byproducts should be utilized wherever possible: among them yeast and carbonic acid being most important. The yeast can easily be washed and dried, when it will keep well and on account of its high protein contents will form a welcome addition to any stock feed. As for the carbonic acid, an amount approximately equal to two-thirds the weight of the alcohol can easily be recovered in a state of high purity; this is always in great demand in the Tropics for the manufacture of carbonated beverages and can also find use in refrigeration and in the conditioning of fruit for shipment. Although some additional capital must be invested in the utilization of the byproducts, it would be a sound and profitable investment and the utilization of all waste material must necessarily help to lower the cost of the motor spirit, which is, of course, the main consideration.

After all is said, the manufacture of motor spirit must be put on the same basis as any other industry: Engineers have taken pains in designing plants which almost any one can operate successfully; but no one, so far, has ever come out with a piece of machinery that will do the selling. If this is left to the mercy of a storekeeper who is more interested in accounts than in anything else, the undertaking is hopeless. Successful selling is a science based on service and fair dealing, on a willingness to accommodate and even to educate customers so as to inspire confidence and even friendliness. Nothing short of this can ever bring forth permanent success.

Comparison of Gas and Electricity For Industrial Heating

Although each of these heat sources has applications in which it is superior to the other choice must be governed by conditions

By R. C. Gosreau
Consulting Engineer, St. Louis, Mo.

KEEN competition between gas and electric companies for the industrial heating load is apparent throughout the country. The rapid advances in heating load made by both types of utility companies indicate that less satisfactory methods of heating are being abandoned in many industries. Which of these two heat sources has the superior merit has not been definitely determined for most uses; but there are certain applications in which one or the other shows a market superiority.

The cost of heating in a process should not be based on the purchase price of cubic feet of gas or kilowatt hours of electricity, but should be figured in accord with the degree of utilization possible of the potential energy in the source of heat. The design of the heating appliance and the work it is to do must determine the most satisfactory source of heat energy for it. A purely theoretical comparison is valuable only when no data based upon experience are available. Such a comparison may serve as a starting point, and may also show what can be expected from the appliance.

Fuel Gas as a Source of Heat

The heat content of fuel gas in B.t.u. per cu.ft., determined by laboratory test, is constantly used as a basis for figuring the utility of a fuel gas or comparing it to some other fuel or source of heat. This quantity is not, however, a proper basis for such comparison, because such a laboratory determination, due to the many factors influencing an industrial application but not reproducible in the laboratory, gives no clue to the results of the utilization of the fuel.

There are no means available for easy determination, with even fair accuracy, of the amount of heat energy developed when a cubic foot of gas is burned in industrial equipment. Usually a computation is made to determine the heat energy absorbed by the work and this value is compared to the total heat content of the gas burned, in order to obtain the heating efficiency of the operation of equipment. Such a procedure does not show the actual efficiency of utilization because, although in one case the burner may be efficient and the setting poor while in another the reverse conditions will hold, no distinction can be made.

There is apparently no reason why the rated thermal value of a gas should be the basis upon which the performance of gas burning equipment is rated. It would, however, be of great value to know what energy a burner developed and with that figure as a base, compare various applications of heat to work. The result might be called the utilization rather than the efficiency of the fuel because it would show what percentage of the total heat units in the gas are used in the work. Then the utilization percentage would be the heat developed by the burner compared to the heat used, all heat losses being subtracted.

Just what proportion of the heat content of a gas is developed by a burner is not definitely known, but there are probably no burners that develop the same quantity of heat energy per unit of gas volume burned as is evolved by a laboratory calorimeter.

Some furnaces and other equipment will show a high utilization of the heat energy in the gas, if compared on the basis of energy developed at the burner. Other devices do not show as high an overall utilization of this energy. One other important factor affecting the utilization percentage is the rate of heat absorption by the work. The rate of heat energy input into the equipment should be related to the capacity of the work to absorb heat, or the heat losses will be excessive. In general, the larger the chamber in which the absorption takes place, the faster is the rate of heat transmission to the work, provided the chamber walls are at all times higher in temperature than the work. This fact is due to the greater radiation realized. But such large radiating surfaces also increase the radiation losses from the outside of the furnace. Under these conditions, if the rate of heat input exceeds the rate of absorption by the work, the excess must be represented in increased radiation from the outside of the furnace. Another important factor influencing this utilization percentage is the rate of temperature change within the work.

The tendency in designing equipment is to build the setting so that a maximum of heat generation may be accomplished in a minimum of space, which results in decreasing the heat losses and accelerating the process to which the heat is applied.

Gas-fired furnaces at working temperatures from 1,000 to 1,800 deg. F. are often characterized by the large furnace volume as compared to the unit size of the work to be heated. This is due to the manner of burning the fuel, the manner of applying the heat and the arrangement for utilizing waste heat. The proper application of the heated gases to the work that is being heated depends on the properties of the material of which the work is composed and whether the heating may be done in an open or closed chamber. The higher the specific gravity and temperature of the combustion gases, the greater is the quantity of radiant energy transferred. The ability of these gases to perform a maximum of useful work depends on the method of applying the heat energy contained in them and also on the rate of absorption of the work for this energy. As the

specific heat and the conductivity of the material heated may vary, so will the rate of absorption of heat energy vary. Any rate of heat energy generation faster than the rate of absorption means a loss. Therefore, the furnace volume should be as near the volume requirements of the work as may be.

Calculations of heat losses and heat utilization are generally but approximations, wide of the actual fact. Gas fuels in competition with other types of heat suffer injustice in such calculations, because they are based on factors determined in a laboratory under scientific methods of control and measurement. What really matters is whether the fuel proves economical in actual use.

The fuel requirement of a gas burning appliance is generally the first thing considered. The hourly demand for gas is a measure of the hourly rate of doing work. The rate of transfer of energy is variable, depending on the high and low temperature masses. High temperatures have greater intensity than low and at high temperatures molecular activity is greater. Also radiation is more intense at high temperatures.

For the transfer of heat from a furnace wall to an object within, the wall must first be brought to the temperature to which it is desired to bring the object. Should the object be heated first, then before it can reach a state of equilibrium of temperature, the walls must reach the same temperature. In most heating furnaces, the furnace is of greater surface and volume that the object being heated, so the walls, roof and bottom first reach the working temperature, then the heat transfer by radiation, conduction and convection proceeds.

In some equipment an attempt is made to heat by direct flame radiation. In such cases the flame impinges directly against the work that is being heated. When such a procedure does not harm the work it is more economical than indirect heating, but the practical disadvantage lies in the difficulty of control. When a muffle is used, heating is the slowest and most expensive, as the utilization factor is low. Another method of heating is to carry the hot waste gases along the furnace roof at a low velocity, the roof being well insulated. These gases radiate heat downward to the work. To be thermally efficient such a furnace must have provision for using the heat remaining in the gases after they have left the furnace. Heat energy transfer from hot gases depends on the gas velocity, which should be low for good results. In any heating device using gaseous fuel, the rate of heat energy development and the rate of heat energy absorption must be synchronized so that the work can take up the energy as rapidly as it is developed.

Heating with Electricity

There are three ways of applying electrical heating: By direct or radiated arc; by direct or radiated resistance; and by high frequency induction. In arc heating the material may be heated by radiation from an arc not in contact with the work, or the arc may make direct contact with the work in which case the heating is by radiation and also by energy given off from the arcs of contact between the electrode and the work. In resistance heating either the resistance elements radiate their heat to the work through the furnace atmosphere, or the heating is direct by passing the current through the work which becomes a part of the electrical circuit. In high frequency induction heating, an induced current is set up in the work, which is part of a secondary circuit, by means of a high frequency current in the primary circuit.

Electrical and gas heating compete mostly in the range from 100 to 2,000 deg. F., which covers the largest part of the field of each. Although many operations using gas are conducted at temperatures above 2,000 deg. F., the cost of gas fuel on these installations very nearly equals the cost of electric energy in most parts of the United States. The choice as to application is properly divided into two considerations—an economic and an engineering consideration. The recent rapid increase in the amount of current used for melting and heating metal shows that electricity can often compete economically where quality is paramount.

In the choice of direct resistance heating the shape of the piece to be heated is a governing factor. An intricate piece cannot be made to carry a current satisfactorily and heat uniformly. The direct resistance method is successfully applied to straight pieces and also to welding, shrinking and surfacing operations.

Resistance heating by radiation applies to every process using heat in a range from 100 to 2,000 deg. F. The only limitation of this method lies in the ability of resistors to withstand heat. The material composing the resistors possesses definite electrical properties. These, for proper resistor material, are nearly constant and provide a basis for comparison. Given the specific resistance of the resistor material, the heat developed by any energy input can be closely computed. From the metered electrical input, the heat energy dissipated in the element can be computed.

The heat energy in this type of furnace is utilized both by convection and by radiation, the effect of conduction being reduced to a minimum. Conduction implies contact, which is not practical, but by placing the work as near the resistor as possible radiation is increased to a maximum. The following significant points constitute good designs for electrical radiation heating apparatus: (1) The elimination of air currents passing in and out of the equipment except as required in the process. (2) Compactness of design incorporating a self-contained unit. (5) (3) Maximum receptive surfaces as compared to the area of generative surfaces. (4) High rates of energy input consistent with the required rate of doing work. Generating surface so formed as to radiate the maximum amount of heat energy directly to the work. (6) The focus of radiation in the work, not elsewhere. (7) No flues or stacks to cause air currents and consequent heat losses except in cases where vapors or gases from the work must be led away. (8) The work can be placed as near as practical to the heating elements. (9) Heating elements can be placed on all sides of the work. (10) Adequate insulation and dense, hard-burned refractories can be used. (11) Insulation can be thick while refractory walls need only be thick enough to withstand the temperature. (12) Joints can be made close and tight fitting with a minimum of joint material. (13) The ratio of furnace volume of work volume can be near unity.

Economic and Commercial Considerations

The selection of gas or electric heating appliances by a manufacturer presents a problem. Gas and electric rates are not equal from the standpoint of available heat energy. The final decision as to which to use is not generally made upon which source gives the largest

amount of heat units per dollar expended, or upon which gives the greatest overall efficiency in the process, but unfortunately is largely a matter of salesmanship.

If the cost of heat energy as translated into production were the same or nearly the same for both of these two sources, then the choice would be a mere matter of initial cost of equipment and of purchaser's whim. In many processes the cost of the product must bear an almost fixed standard ratio to the selling price. An increase in quality should bring an increase in sales, if not in unit selling price. In other cases, an increase in quality certainly warrants an increase in price. When it is evident that quality is improved by the use of one or the other of these sources of heat, then the reason for its adoption is clear. Certain other factors like quantity of production, cleanliness of process or convenience of control also indicate the adoption of one of these sources of heating, but in other cases it is purely a matter of salesmanship.

The true factor to consider in the cost of the heat energy for any process is not the absolute cost but what is the relative cost in the final cost of the product. Or in other words what is important is not the cost of a unit of energy supplied but the cost of a unit of heat energy entering into the process, which consideration involves the utilization percentage.

The use of electricity or gas for supplying heat energy implies the use of specially designed equipment. Many users feel that they can build equipment for this purpose that will equal any they can buy. Such a view is almost always incorrect and almost always, where such equipment is used, the working conditions, the quality of the product and the economy of the operation can be improved.

Here the question arises as to the cost of equipment for these two fuels, including both the primary and accessory equipment necessary to do a piece of work. An example might be given of a high pressure, gas-fired, semi-muffle furnace to operate up to 2,000 deg. F., including furnace, compressor and motor, burners and accessories, the total cost of all being near $6,000. An electric furnace to do the same work including transformers, meters, wiring and switches with the heating elements, will cost around $18,000. Both furnaces will have the same advantage as to quality of work, convenience of operation and cleanliness, but the electric furnace will produce nearly three times the product of the gas fired furnace.

In cases where the more costly equipment delivers the heat energy to the work in a more satisfactory manner it would be both poor engineering and poor economy to buy the lower priced equipment because of price alone. Equipment that shows a high operating cost in relation to the value of the product produced may have other factors offsetting this high cost so that in the last analysis there is little difference, or the situation is reversed.

The cost of energy in fuel gas and electricity varies in different parts of the country. So many factors are concerned that a definite example for one locality would not hold good in any other. The value of heat energy from any source can be computed in cents per million B.t.u. Suppose the gas rate to industrial consumers in a certain city is 70 cents per thousand cu.ft., and the rated heat content is 585 B.t.u. per cu.ft. Then it requires 1,710 cu.ft. to yield 1,000,000 B.t.u., and the cost would be $1.20.

Suppose in the above case the industrial burner is able to develop but 420 B.t.u. per cu.ft. of gas burned, that is the efficiency of the burner is 72 per cent. Then 2,382 cu.ft. of gas must be burned to develop 1,000,000 B.t.u. This amount of gas by calorimeter determination contains 1,390,000 B.t.u. and the charge for it would be $1.67. From this it will be seen that the gas company charges $1.20 per 1,000,000 B.t.u. delivered, while the consumer pays $1.67 for each 1,000,000 B.t.u. utilized. This indicates that the smaller the customer's utilization percentage the greater is his gas cost.

To deliver 1,000,000 B.t.u. in heat energy generated from electric current, the heating element must develop energy equivalent to 293 kw.-hr. Not all of this energy is radiated but represents the equivalent conversion of electrical to heat energy. With gas at 70 cents per thousand cu.ft., the equivalent price of electrical energy is 0.568 per kw.-hr. Many gas-fired installations pay a higher rate for gas and consequently the equivalent cost of electrical energy is higher. Allowing for losses in the electrical system of 10 per cent, the rate for electric energy increases to 0.63 cents per kw.-hr. The mention of such a rate for electricity may arouse some protest, but there are some plants generating their own current that meet this figure. The equilibrium between gas and electric cost at rates that consumers can afford to pay, depends entirely on the degree of utilization of the potential energy in the fuel and how this energy can be developed to its maximum value. In many cases, gas, in spite of its lower unit cost, does not show a lower net cost.

Suppose that 1,000,000 B.t.u. or 293 kw.-hr. is sold at 1½ cents per kw.-hr. Then the total cost of the 1,000,000 B.t.u. amounts to $4.40. This same quantity of energy in gas at 70 cents per 1,000 cu.ft. costs $1.20. If the overall utilization of the energy in the gas is 50 per cent, the consumer must purchase $2.40 worth of gas to do the work of 1,000,000 B.t.u. This figure for gas will vary in proportion to the utilization value and the rate as determined by the monthly consumption. To equal the electrical energy cost the gas would have to be sold for $1.29 per 1,000 cu.ft. basing this on a 50 per cent overall utilization value. This low utilization value for energy in the fuel may often present a problem requiring a further operating cost to control. Any further operating cost means something added to the cost of burning gas. Many electrical industrial furnaces are operating with an overall utilization of the potential energy consumed approaching 85 per cent.

The cost of a fuel is greater or less as it is used or wasted. In burning coal the tendency is to waste most of the energy. This is possible because a ton of coal may contain 26,000,000 B.t.u. and if it costs $5 the cost is only 19.2 cents per 1,000,000 B.t.u. If 20 per cent of the heat is utilized this heat costs 96 cents per 1,000,000 B.t.u. In the case of oil, suppose a gallon of crude oil contains 130,000 B.t.u. and costs 6 cents. Then 1,000,000 B.t.u. costs 46.2 cents. If the overall utilization of this energy is 50 per cent, the energy cost is 92.4 cents per 1,000,000 B.t.u. obtained from oil. The figures for gas and electricity have been given above. These figures show that as the unit value of energy in any fuel increases, the percentage of utilization must increase or its use becomes prohibitive. As a consequence, the cost of a fuel is not the determining factor; but the degree of utilization is the prime, important and only factor to consider in its application in any heating process.

Absolute Alcohol by Distillation

Now produced in France on large scale from ternary mixture: benzene-alcohol-water

By H. Guinot
Distilleries des Deux-Sèvres, France

LARGE-SCALE dehydration of alcohol became an acute problem in France in 1921, when the Government desired to dispose of the war accumulation. The first efforts were along the lines of the Loriette method, in which the vapor is passed over quicklime (CaO). This process went into production in several plants; but the mechanical difficulties of large scale operation were such that it was soon abandoned.

The next proposal was to mix the alcohol first with a suitable quantity of gasoline, and to dry the mixture with a salt such as potassium carbonate. This proved to be an economical method, but it was not attractive to the Government because its usefulness was limited mainly to alcohol for motor fuel. It was, in fact, an attempt to recover absolute alcohol from such mixtures of alcohol and gasoline that led to a successful study of the commercial distillation method.

In 1923 the method of distilling the alcohol in presence of water-insoluble liquids (such as benzene) was introduced. So rapid has been its growth that in the last two years it has been used in France for dehydrating about 6,600,000 gal. of alcohol, compared to about 800,000 gal. by all other methods. Present installations in France have a capacity of about 42,000 to 48,000 gal. per day. It is even probable that absolute alcohol as a new industrial commodity will in the future be produced at a lower cost than the 95 per cent grade now commonly used.

Process in Theory and Practice

The principle on which this method depends is this: Benzene, water and alcohol form a ternary mixture (C_6H_6 74.1, C_2H_5OH 18.5 and H_2O 7.4 per cent) boiling at 64.9 deg. C. Benzene and alcohol form a binary mixture (C_6H_6 67.6, C_2H_5OH 32.4 per cent) boiling at 68.2 deg. By using a very efficient fractionating column it is possible to get a satisfactory separation; the ternary mixture comes off first, carrying all the water with it; then comes the binary mixture, carrying the remainder of the benzene; and absolute alcohol is left behind. The theory of the distillation is thoroughly discussed by Barbaudy in his dissertation, *Contribution a l'Etude de la Distillation des Melanges Ternaires Heterogenes*, published by Hermann, Paris.

In practice, an ordinary distilling column *A* (see Fig. 1) is charged with alcohol and distillation is begun, all the first condensate being returned. Benzene is then added gradually through the feed pipe *T* until the thermometers along the column begin to show a temperature drop. Addition of benzene is stopped when the thermometer at t_1 drops 2-3 deg., showing the presence of a few per cent of benzene at that height (8 or 10 plates up). The column is then ready for continuous dehydration; the benzene goes through a cycle with very little loss. Fresh alcohol is added through the pipe *T*, which enters the column at just the point where the benzene is in the optimum concentration for rapid dehydration. At the same time the condensate from *R* appears in the decanter *D*. This portion of the distillate separates into a lower (16 per cent) and upper (84 per cent) layer. The upper layer, rich in benzene, is returned direct to the main column; the lower layer is distilled in the small column C_1 till it reaches the composition of the ternary mixture. It is then returned to the main column. The dilute alcohol in C_1 is distilled in another small column C_2 to give 95 per cent alcohol, which is returned to the main column of the still.

In *A*, aqueous alcohol falls from plate to plate, gradually giving up its water to the benzene. Toward the bottom of this column is a zone of plates charged with the binary alcohol-benzene mixture boiling at 68.2 deg. C. If desired, the liquid condensed in *R* may be dehydrated by a chemical agent such as potassium carbonate instead of going through *A*. In that case, the columns C_1 and C_2 are unnecessary, and there is a saving in steam. This saving, however, is not great; the greater part of the heat expended is used up by column *A*.

The amount of steam used is by no means directly proportional to the amount of water removed from the alcohol; a plant equipped to produce 100 volumes per day of 100 per cent alcohol can produce 150 volumes of 99.8 per cent alcohol. The maximum steam requirement is about 16 lb. of dry steam per gal. of 100 per cent alcohol, starting from 96 per cent alcohol, or a little less than 12 lb. for 99.8 per cent alcohol. The latter grade is suitable for most uses. However, on account of its greater solvent power, absolute alcohol is more useful in many industries than the aqueous grades. It is also useful in the manufacture of ethyl esters and other ethyl derivatives.

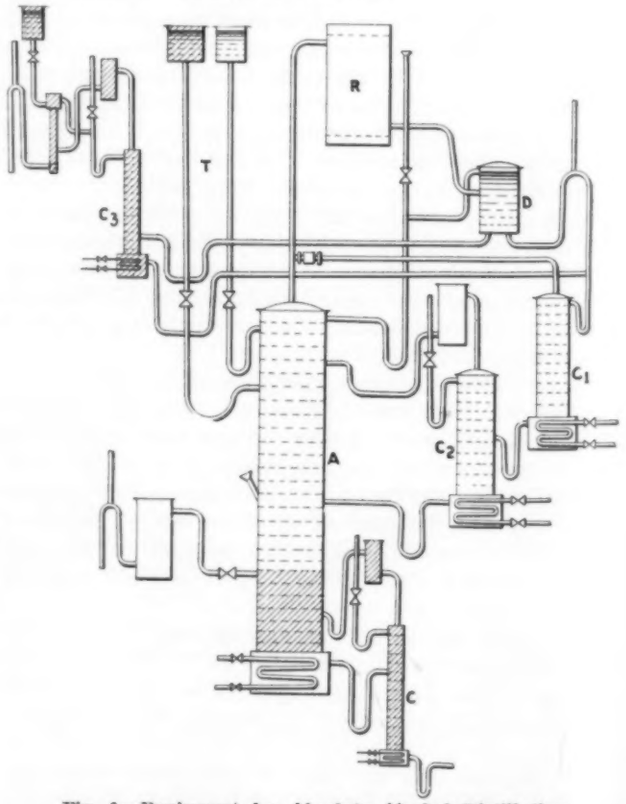


Fig. 1—Equipment for Absolute Alcohol Distillation
Shaded portions represent the extra equipment required for simultaneous dehydration and purification of denatured or dilute grades. The lighter portions indicate equipment for producing absolute alcohol from the pure 95 per cent grade

Translation and abstract by Dr. Julian F. Smith, Akron, O., of an article appearing in *Chimie et Industrie*, Vol. 15, No. 3, pp. 323-30 (1926).

Automatic Control Improves and Simplifies an Industry

Recovery of gasoline by absorption process presents savings effected by replacing men with control devices

By S. D. Kirkpatrick
Associate Editor, *Chem. & Met.*

RECOVERING gasoline from natural gas is not an old industry—the first plant was built in West Virginia in 1903—but it is one in which rapid commercial progress has quickly followed technical development in process and equipment. As a measure of this increased production efficiency we find that the average yield in the natural gasoline industry has risen during the past ten years from 0.496 gal. per 1,000 cu.ft. in 1916 to well over 0.9 gal. in 1925. As an index of commercial growth and of the conservation of an important natural resource, it is interesting to observe that during 1924 the industry recovered gasoline from approximately 1,016,276,000,000 cu.ft. of natural gas which was 89 per cent of the total consumption of natural gas in the United States. This "index of conservation" has also shown a steady increase, mounting from 27 per cent in 1916 to 54 per cent in 1917, to 71 per cent in 1922, and to 87 per cent in 1923. The natural gasoline industry is now supplying approximately a tenth of our total consumption of motor fuel and in the present scheme of production its contribution is essential to the maintenance of proper volatility and other desirable qualities.

The industry has been able to meet the insistent demand from the refiners largely because of its willingness to adopt labor-saving devices and other available means of improving production efficiency. One of these means that has made a conspicuous contribution to the industry's technology is the wide use of automatic-control. In fact, this development has been carried farther than in most industries and it is believed that a description of the operation of a typical gasoline absorption plant may prove suggestive of means for improving the control and, therefore, increasing the efficiency in other chemical engineering processes.

The low-pressure, compression-absorption plant of the Chestnut & Smith Corporation at Glen Pool, Okla., is representative of the many modern installations in the Mid Continent. In this plant about 1,500,000 cu.ft. of rich gas from the Kiefer field is treated each day to produce about 15,000 gal. of gasoline, yet operations have been so mechanized that the entire production is carried on by four men per shift—an engineer, an absorption operator, a boiler fireman, and an oiler. Batch processes are notably absent and the absorption and compression circuits have been co-ordinated into closed cycles requiring but little manual adjustment to maintain their continuity. Thus the superintendent in charge of production and the chemist responsible for records of operation, quality of product and shipments, are able to serve the several plants maintained by the corporation in this field. And production is more efficient as the human element is replaced by the thermostatic control, the automatic level regulator, and the various temperature and pressure devices.

In the absorption process, temperature and pressure are determining factors. Temperature affects the volume of the gas being treated, the efficiency of the extraction process, the character of the absorbed hydrocarbons, and the absorbing capacity of the oil. Pres-

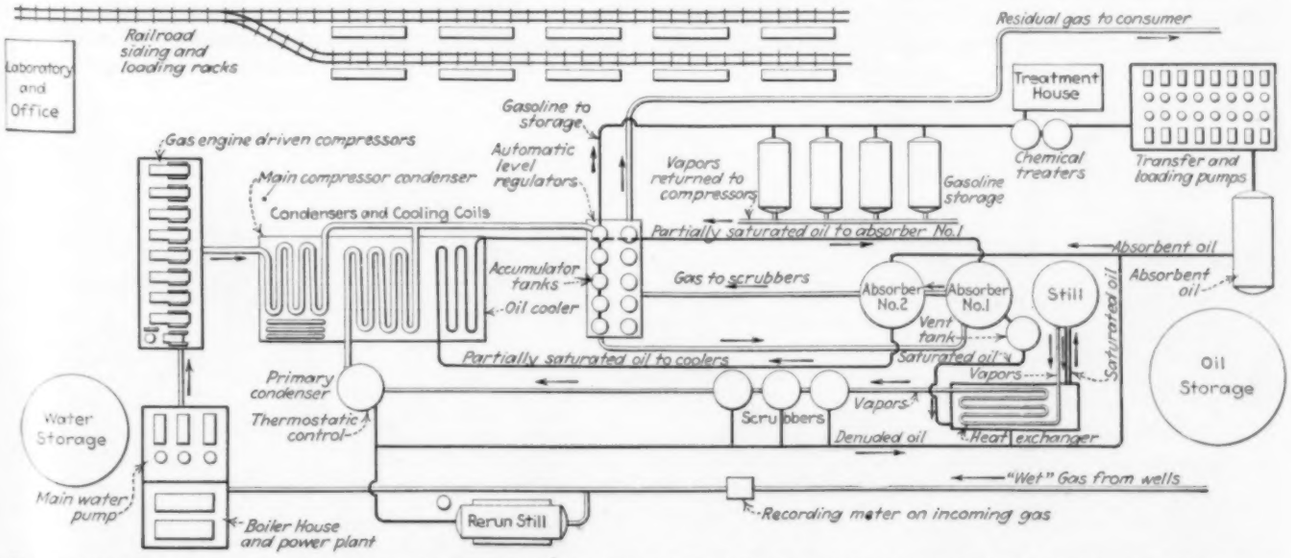
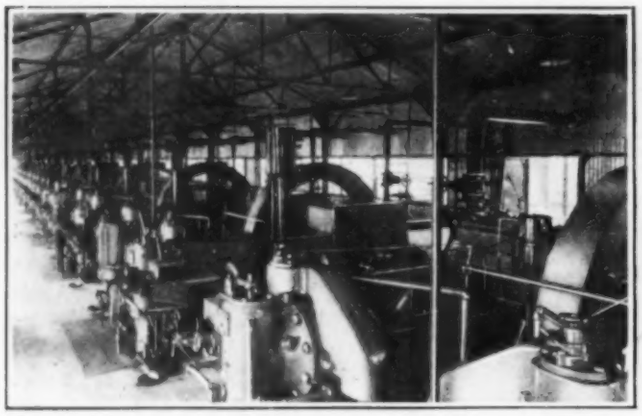
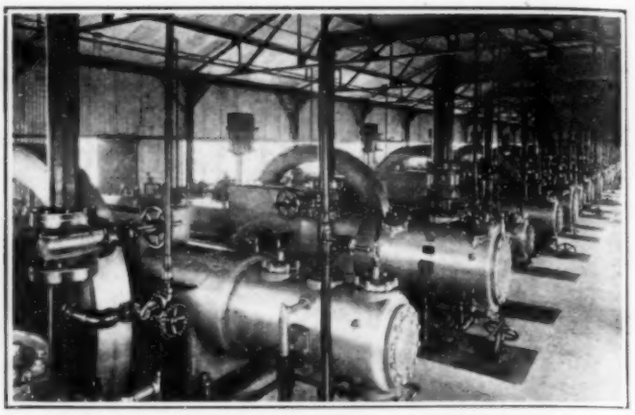


Fig. 1—Schematic Layout of a Natural Gasoline Plant Showing the Principal Equipment, the Approximate Path of the Gas Through the Compressors and Absorbers and the General Cycle of the Absorbent Oil





Figs. 2 and 3—Views of the Compressor Room in a Typical Natural Gasoline Plant in the Mid-Continent Showing the Usual Type of Gas-engine Driven Equipment

sure likewise determines volume but also controls the velocity of flow and the saturation of the absorbent. It places the structural limits on the design and construction of practically all of the equipment.

Absorption Follows Compression

The panoramic view of the Glen Pool plant and the general layout which has been roughly sketched in Fig. 1 are helpful in following the course of the gas through the recovery processes. The rich gas from the field which may contain from 5 to 18 or 20 gal. of gasoline per 1,000 cu.ft. is drawn to the plant under an average vacuum of about 25 in. of mercury (12 in. at the plant) and its total volume is continuously recorded by a Foxboro orifice meter. The gas is compressed to a pressure of 30 lb. per sq.in. in the compressor room, the principal equipment of which consists of six direct-type 80-hp. Bessemer gas-engine driven compressors with air cylinders 14 in. x 20 in. and engine cylinders 16 in. x 20 in. In addition two 100-hp. induction motors drive auxiliary equipment consisting of two 2-cylinder Ingersoll-Rand imperial type compressors. Views taken in the compressor rooms of typical gasoline plant in the Mid Continent are shown in Figs. 2 and 3.

The gas comes from the compressors at about 175 deg. F. and is immediately cooled in a 12-pipe water-sprayed cooling coil. This compression and cooling is sufficient to remove about 50 per cent of the gasoline content of the gas which is then passed into accumulator tanks where the gasoline is separated from the gas. The liquid level in these tanks is automatically maintained by Fisher oil level regulators made by the Fisher Governor Co. of Marshalltown, Iowa. These are float valves which are similar in principle to standard steam traps and they deliver the condensed gasoline to the storage tanks. The pressure regulator on the gas outlet holds a continuous pressure of about 60 lb. per sq.in. on the accumulators.

The gas then passes through a 6-in. pipe to the first of the two absorbing towers which are vertical tanks of boiler plate construction, 27 ft. in height and 7 ft. in diameter. The absorbers are partially filled with screen baffles which have proved more satisfactory for tower filling than wooden grids, crushed stone, tile or steel shavings—all of which are in use in some plants. The gas enters the bottom of the absorber where it meets the enriched oil and travels up through the baffles to the top and is returned to the base of absorber No. 2 where it is contacted against the leaner oil. Liquid level in the absorber is automatically maintained by Fisher float valves. The gas from the top of the second absorber, which is held at 30-lb. pressure by a back-pressure regulator, passes through scrubbers to the residual line for return to the field or other consuming uses. Before this is done, however, the volume is continuously recorded on a Westcott differential meter. A continuous charcoal tester has been devised by the plant force to determine the small amount of gasoline left in the residual gas. This device draws off a small portion of the gas through a calibrated orifice and into a

Panoramic View of the Low-pressure, Compression-Absorption Natural Gasoline Plant of the Chestnut and Smith Corporation at Glen Pool

small column of activated charcoal. The charcoal column, which selectively adsorbs the gasoline vapors, is replaced by another after 48 hours and the adsorbed gasoline is removed by steam and carefully measured. From this is calculated the residue in the gas which sometimes runs as low as 0.01 gal. per 1,000 cu.ft. The records, thus obtained are an invaluable index of production efficiency and a check on other operations.

Following the Oil Cycle

So-called "mineral seal oil" is used as the absorbent menstruum. This is a crude oil fraction intermediate between kerosene and gas oil, water-white in color, with a gravity of 38 to 41 deg. A.P.I. at 60 deg. F., an initial boiling point of 510 deg. F. and an end point of 660 to 680 deg. F.

The passage of the oil through the absorption towers into the still where its gasoline content is removed, then into the condensers and cooling coils and finally back to the absorbers, forms an interesting cycle, entirely automatic in operation and requiring practically no manual control. The denuded oil is pumped to the top of No. 2 absorber by a duplex pump, then passes down counter current to the up-coming gas and is withdrawn at the base of the tower. The partially saturated oil is pumped through the cooling coils to a recirculating tank from which it is taken by another pump to the top of absorber No. 1. By means of a constant level device in the recirculating tank, this second pump is so synchronized with the first as to increase or decrease the rate of recirculation to conform with the flow of oil through the absorber system.

The enriched absorbing oil from the bottom of No. 1 absorber passes through a weathering or vent tank where its pressure is reduced in order to release the permanent gases taken up during the absorption process. The vent tank has a valve set to open at a predetermined pressure, which, therefore, controls the amount of gas discharge. This gas may be returned to the compressors and absorbers or burned under the boiler, or it may be wasted to the atmosphere. The oil then passes into the still where the gasoline vapors are distilled off and the residual oil is pumped by the hot-oil pump through a tubular heat exchanger to the oil-cooling coils in the condenser pit. Its temperature is there reduced to about 80 deg. F. which has been found to be the optimum practical temperature for the absorption. The denuded oil having thus completed its cycle is then ready for return to the top of No. 2 absorber.

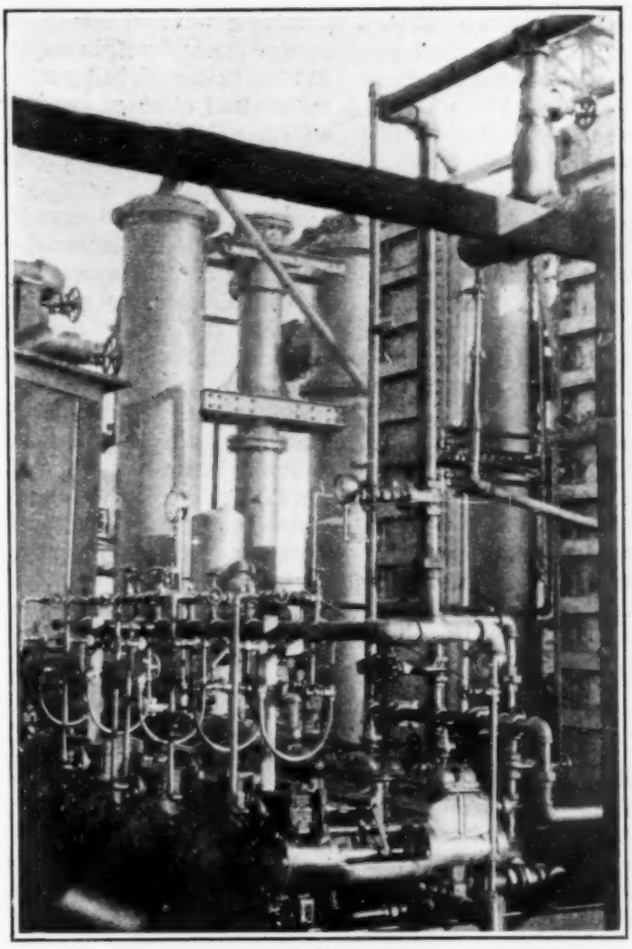
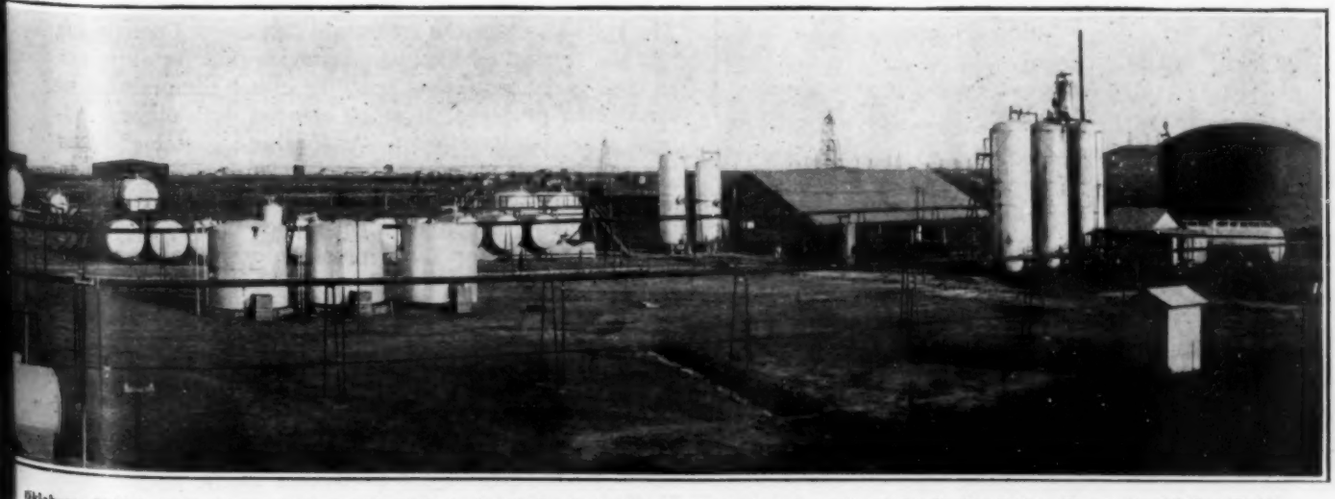


Fig. 4—A Portable Gasoline Plant in the Garber Field Near Enid, Okla.
The recirculating pumps for the absorption oil and cooling water are to be seen in the foreground

The gasoline content of the absorbent oil is removed in a vertical steam still, similar in size and general appearance to the absorbers but well insulated with asbestos cement. It contains a number of baffles and is heated by both open and closed steam coils. Live steam introduced through the open coils in the bottom serves to simplify the control of temperature as well as assisting in the separation of the vapors. A Tycos thermo-



Oklahoma Which Daily Recovers Approximately 15,000 Gal. of Gasoline from 1,500,000 cu.ft. of Casinghead Gas From the Kiefor Field

static control actuates a diaphragm valve on this steam line and holds the temperature of the still within a comparatively narrow range—210 to 212 deg. F. being usual practice. The oil level is maintained at about one-half the height of the still by a Fisher fluid level regulator —the hot oil flowing through the heat exchanger to warm the incoming charge.

The vapors leaving the still at 200 to 220 deg. F. contain not only gasoline but also some of the heavier hydrocarbons from the absorbent oil. These must be completely removed or they will discolor the gasoline and give it a higher end point than is desired. Accordingly, after passing the vapors through the heat exchanger, a careful separation is made in the primary condenser—or so-called "knock-out box" which is held at about 190 deg. F. by means of a Tycos thermostatic regulator. Fig. 6 shows the arrangement of equipment used in one gasoline plant for the control of this operation. The light vapors pass from the primary condenser into the main condenser and the gasoline is pumped to storage from the accumulator tanks. The absorbent oil condensed in the knockout box flows with the water to a trap where the oil is skimmed off and returned for further use.

Hypochlorite Treatment of Finished Products

Since a considerable part of the production of natural gasoline is used in export gasoline and must pass the doctor test before blending with other distillates, many of the modern gasoline plants are equipped to produce a product that will meet specifications of the refiners and blenders. At the Glen Pool plant all orders for such gasoline are treated with hypochlorite solution before shipment—this method having replaced the sodium plumbite treatment formerly used.

A bleaching powder solution containing from 10 to 30 parts per million of available chlorine is made up in a concrete pit in the storage building and is pumped through a jet valve into a 6-in. cast-iron pipe by means of a Gardner 6x4x6 double-acting bronze acid pump. The gasoline to be treated is pumped into the same pipe and is completely mixed with the solution as the two are forced through the 6 orifice plates that comprise this so-called "knot-hole mixer." The mixture then passes to the separator tank or agitator from which the bleach solution is pumped out and over an aërating screen into the solution pit. The gasoline is pumped from the top of the separator to the bottom of a second tower or tank and is washed with water, in order to remove all trace of chlorine. If it is desired to produce a product that will pass the corrosion test, an additional treatment with caustic soda is given.

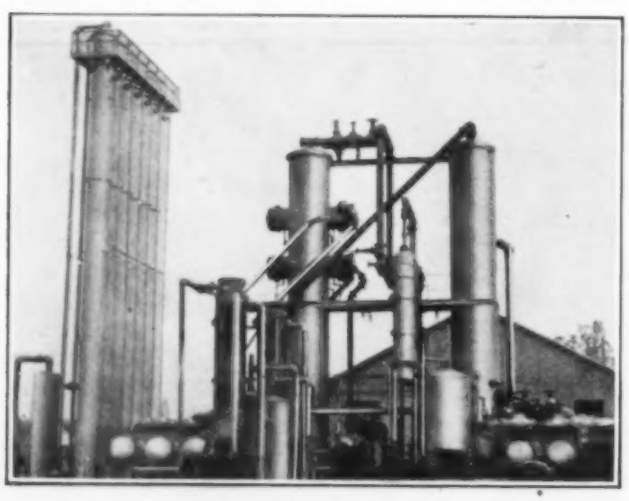


Fig. 5—Absorption and Heat Exchanger Units in a Mid-Continent Gasoline Absorption Plant

According to the specifications of the Association of Natural Gasoline Manufacturers which have been adopted by governmental agencies and other organizations interested in petroleum, five different grades of natural gasoline are produced to conform to the following specifications:

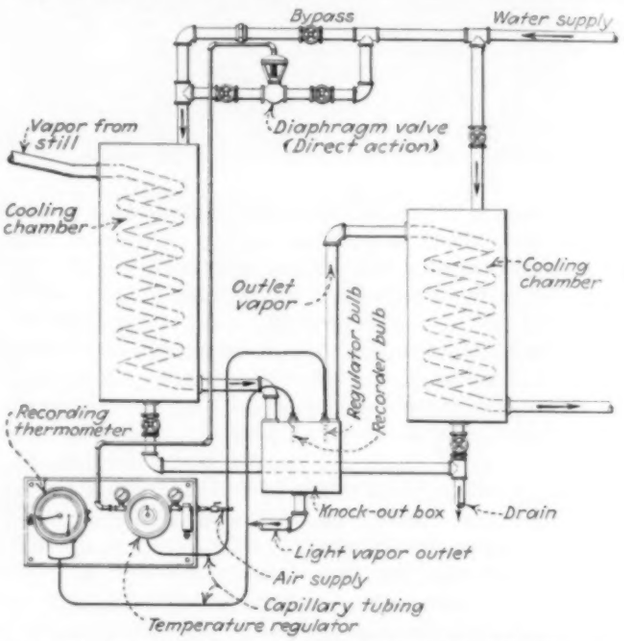


Fig. 6—One Provision For the Automatic Control and the Recording Of the Temperature of the Oil Vapors in the Primary Condenser
The thermostatic regulator here shown controls the temperature of the knock-out box by regulating the flow of cooling water

Grade "Double A"	Recovery	Not less than 90 per cent.
	End Point	Not over 375 deg. F.
	Gravity	80.0 to 87.9 deg. Bé.
Grade "A"	Recovery	Not less than 90 per cent.
	End Point	Not over 375 deg. F.
	Gravity	72.0 to 79.9 deg. Bé.
Grade "Double B"	Recovery	Not less than 85 per cent.
	End Point	Not over 375 deg. F.
	Gravity	84.0 to 92.9 deg. Bé.
Grade "B"	Recovery	Not less than 85 per cent.
	End Point	Not over 375 deg. F.
	Gravity	76.0 to 83.9 deg. Bé.
Grade "C"	Recovery	Not less than 78 per cent.
	End Point	Not over 375 deg. F.
	Gravity	80.0 to 90.0 deg. Bé.

The regulations of the Interstate Commerce Commission and the Bureau of Explosives provide that for shipment in tank cars the product made by either compression or absorption processes alone or blended with other products, must be described as "casinghead gasoline" when the vapor pressure at 100 deg. F. (90 deg. F. Nov. 1 to March 1) is greater than 10 lb. per sq.in. and less than 20 lb. Such products must be shipped in insulated class 4 tank cars. If the vapor pressure does not exceed 10 lb., the condensates or blends are described as "gasoline" and may be shipped in tank cars of class 2 or 3 or insulated cars of class 4.

The writer is indebted to D. E. Buchanan, vice-president, Chestnut & Smith Corporation, Tulsa, Okla., for the privilege of visiting the corporation's plant at Glen Pool, and to W. W. Smyers, superintendent, and W. R. Lentz, plant chemist, for assistance in the preparation of this article.

Artificial Wool Manufacture

Production of new fiber by Snia Viscosa may foreshadow another rapid development in textile industry

By Dr. Hans Drexler
Munich, Germany

LATELY much interest has been shown in the character and the future prospects of the new textile fiber which has been named "artificial wool." This material is quite different from that of the same name manufactured in Germany from damaged wool or shoddy. In appearance and texture it closely resembles natural wool; but it is a synthetic product manufactured in a way very similar to that used in making rayon.

In the manufacture of artificial wool, the Italian firm Snia Viscosa, at Venaria Reale, near Turin, appears to have taken a leading part. In October, 1925, this concern made known that it would shortly bring on to the market its new artificial wool product, "Sniafil." At the general meeting of this concern held on February 20, 1926, it was stated that the October announcement had been received with a good deal of scepticism, but that the production of Sniafil was now a fact. Also that the new fiber could be spun to produce a length of 66,000 meters per kilo and that its use would probably be as an admixture with other textile fibers.

It was also stated that the new product was easy to dye. At the same time it appeared from the statements at that meeting that production had not been completely perfected, and the report referred to the introduction of new machines by which it was expected to make a great improvement in the manufacture of the fiber.

With regard to the manufacturing method used by this concern, it has been reported to be based on a French discovery which has been patented in Germany. It is well known that before the Snia Viscosa took up the idea of manufacturing artificial wool, several chemists had been engaged on research in this sphere, but as to the results of this work, very little has been made public. But on this point some information has been published recently by Bigatuso Mauro, the head of the Italian official department for the examination of material.

Schwartzer's Nitric Acid Process

According to Signor Mauro, a chemist named Schwartzer was first in the field, followed later by another chemist named Villedieu. The latter, however, chemically treated already known fiber to convert it into a product resembling natural wool.

Schwartzer's method is to treat cotton with concentrated nitric acid. A low temperature must be maintained, which makes the treatment period rather long, but the product has a fine gloss and is soft as natural wool. It is also possible to increase its resemblance to natural wool by giving it a crimped effect, which is characteristic of the natural wools. This product is stated to be about three times as strong as natural wool and to take dyes more readily. It is claimed further that the heat conductivity of the synthetic product is even less than that of natural wool, a statement, however, which other evidence seems to discount. Mauro thinks that the low heat conductivity may be due to the fact that the nitric acid removes and throws out all waxy and starchy matters that occur naturally in cotton.

A Basle concern is stated to have taken up the Schwartzer process and to be already producing the synthetic material; and another concern has been formed in Paris for the same purpose. A possible drawback to the Schwartzer method is the use of the somewhat expensive reagent, nitric acid. This will involve the recovery of the acid from the spent liquors, which will call for a large capital expenditure.

Villedieu treats jute instead of cotton. The jute is acted upon by caustic soda to which sodium peroxide and oil are added. From this treatment the jute fibers acquire a glossy appearance and the softness of natural wool; they can also be given the crimped effect similar to that of the natural wool fiber.

The fiber is combed and spun, yielding a product of the general appearance and texture of genuine wool from which it is distinguishable only by experienced persons. The Villedieu process, however, is not at present being worked industrially. According to Mauro, its introduction into the industrial field was checked by the appearance of the Sniafil process, which is superior.

Snia Viscosa Probably Uses Xanthogenate Process

The process of the Snia Viscosa is naturally kept secret for the present. Signor Mauro assumes, however, that the patent is based on researches made by Beltzer first mentioned in 1906, but in regard to which no patent was obtained. According to this method, cellulose, preferably derived from the wood of poplar trees, when first subjected to a soda treatment and then to a treatment with carbon disulphide, yields xanthogenate. The subsequent stages of the manufacture are the same as those in the manufacture of rayon; that is, the xanthogenate is mixed with a suitable quantity of water and extruded under pressure through small holes. The resulting fiber is very fine and soft, of a glossy appearance, and a crimped form. It is less elastic than natural wool fiber but considerably stronger. After a washing in a dilute alkali bath, the fiber is marketed, either in the crude or the combed condition, at prices which are naturally far below those for natural wool of equal fineness. Although in appearance and texture the artificial wool is so nearly like natural wool as to deceive the inexperienced examiner, chemical and microscopic methods of examination readily show great differences. The most simple of all tests is to burn a strand; natural wool in burning gives out the characteristic odor of burning hair and leaves a carbonized residue, whereas the artificial product burns like paper. Another difference between the two materials is the property of "felting." A microscopic examination of a natural wool will show the fiber to be covered by an overlapping system of tiny scales arranged like slates or tiles on a roof. By friction, pressing, or "fulling," an interlacement one with the other of the fibers occurs, but with the even surface of the manufactured fiber no such matting or felting is possible.

With regard to the relative heat conductivities of the natural and artificial wools, it is a well-known fact that natural wool is an excellent insulator. This property gives to wool clothing its capacity for preventing a rapid escape of the body temperature and also to minimize the entrance of cold through the clothing to the

Translated from the *Deutsche Bergwerks Zeitung* of May 8, 1926, by W. G. Rumbold, Balham, England.

body. This is true to a much smaller degree with artificial wool whatever claims may have been made to the contrary.

It is not difficult to see that the new product will become established commercially much more quickly than was rayon, which was first produced about 40 years ago. This opinion was expressed at the recent general meeting of Snia Viscosa, at which it was also suggested that foreign countries, England in particular, might seek to check its importation by means of a protective tariff.

One of the first undertakings to take up the manufacture of the new product is the British branch of Snia Viscosa, but according to press notices, this is not to be the only English artificial wool factory. A company known as "Silvandor, Ltd." is reported to have built a factory at Kendal in Westmoreland, and to have already commenced production. As this company has been formed entirely by British capital, it is improbable that it is using the same process as Snia Viscosa. It has been reported also that the Vistra-Faser A.G., a German concern with a capital of 20,000,000 marks, has been formed to manufacture artificial wool. Certain German circles have long been occupied with the problem of producing an artificial wool, and at the last Leipzig Fair, a Ludwigshaven firm exhibited a fiber named "Loda" which was stated to be an artificial wool.

In some quarters the new product and its possibilities have been adversely criticised. The Australian Institute for Scientific and Industrial Research is among those not favorably impressed. Australia is a great sheep-breeding country and is, therefore, likely to suffer injury by the production of a substance that can replace natural wool at a comparatively low cost. The British wool industry appears to regard the discovery of artificial wool without apprehension. W. Priestley, a prominent man in the wool industry, recently stated at Bradford that the term "wool" was a misnomer, as the product is much more akin to rayon than to natural wool. He emphasized also, that no one could make a product like natural wool in a synthetic way.

Whether he is right or wrong in this view will soon be known. Similar scepticism prevailed for about 20 years regarding the possibilities of producing rayon. As a matter of fact, the new product may produce a far greater revolution in the textile industry than has done the production of rayon. The annual production of rayon is now about 85,000,000 kilos against 40,000,000 kilos of natural silk. The production of natural wool is about 1,300,000,000 kilos annually, and of cotton about 5,800,000,000 kilos.

Volatility of Motor Fuel

In the article by H. C. Dickinson entitled, "When Is Gasoline Satisfactory as Motor Fuel?" which appeared in the May issue, the following paragraph was omitted from p. 294:

"Too low an initial boiling point may cause a fuel to vaporize in the metering jets of the carburetor under hot summer conditions and stop the engine. Such fuels, however, are rarely marketed in summer for other reasons, such as high evaporation losses and risks in handling, therefore the above difficulty known as 'vapor lock' is not common but is so troublesome when it does occur that the initial volatility must be kept high enough to avoid it."

Testing Corrosion of Iron

Simple laboratory method of determining relative corrosion rate shows purity of metal to be big factor

By T. Fujihara
Carnegie Steel Company

ACCORDING to the electrolytic theory of corrosion, the initial corrosion of iron is due primarily to an attack of hydrogen ion on the metal. This originates between the metal and an inclusion, forming a set of galvanic cells in which the metal is electro-positive to the inclusion. For this reason, the more numerous the inclusions present in the metal, the more is the resulting corrosion.

Alcohol-Water Mixture Used in Tests

In order to test out this effect of inclusion upon corrodibility of iron, the author has discovered a corrosive mixture in which various kinds of iron in respect to its purity can be successfully differentiated. The mixture consists of equal parts of distilled water and ethyl alcohol. In testing specimens of iron with this mixture, the author used three specimens: (1) electrolytic iron melted in vacuo, (2) "Armco" iron, and (3) wrought iron, each of which was placed for several days in a test tube containing the mixture. The results showed that wrought iron corroded most, "Armco" iron is the next, and the electrolytic iron was corroded least. As to effectiveness of the mixture, a reasonable explanation may be stated as follows:

The corrosive power of water may be weakened by addition of alcohol, which is non-corrosive and a proper mixture of these two liquids will therefore differentiate the rate of corrosion of different grades of iron.

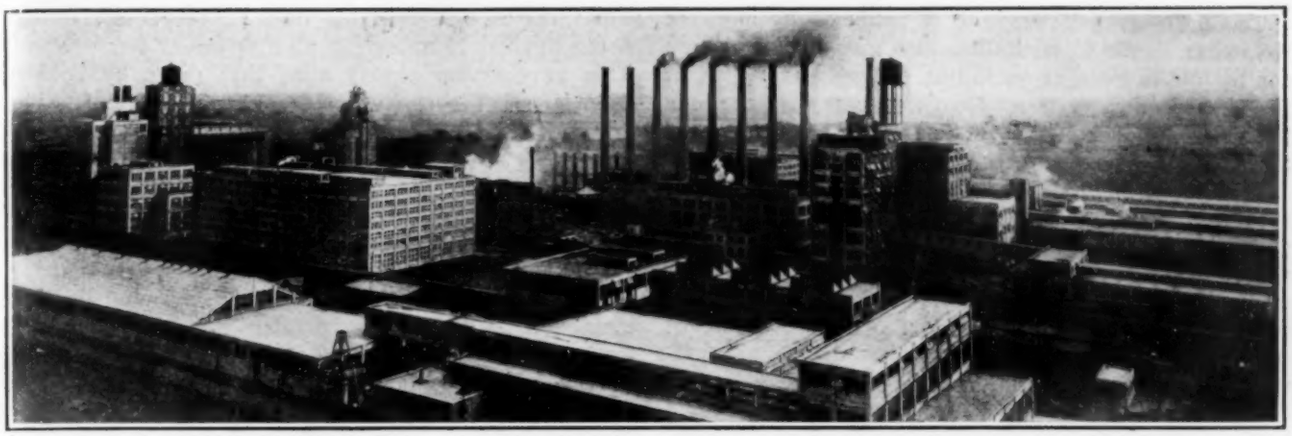
It was also found that the effect of the mixture can be intensified if the specimens are etched deeply with a 5 per cent alcoholic solution of HNO_3 so as to produce a protective film around the metal. This mechanism has already been described by the author in his paper on "Passivity of Iron by Dilute Nitric Acid" (*Ind. Eng. Chem.*, 1926, vol. 18, No. 1).

Differential Corrosion Explained

On applying this process to electrolytic iron (melted in vacuo) and to "Armco" iron, definite results were obtained. After the specimens had been immersed in the mixture for one week, it was found that "Armco" iron started rusting and the electrolytic iron remained bright. The explanation can be stated as follows:

When specimens of various grades of iron are tested by this mixture, the lowest grade of iron, such as wrought iron, will immediately start rusting as was described above. But attention should be called to the fact that the corrosion product is protective, as discussed by many investigators, including the author, and therefore the differential effect of the mixture can be retarded. The best grade of iron does not start rusting readily, therefore produces less protective film. Specimens of treated with dilute nitric acid, however, are equally protected by the protective film whatever the grade of the iron may be. Hence, the best grade of iron will remain unattacked.

The foregoing experimental work was conducted in Dr. A. Sauveur's laboratory, Harvard University.



One of the Largest Units in the New Corn Sugar Industry—Plant of the Corn Products Refining Co., Argo, Ill.

Manufacture of Refined Corn Sugar

Production of pure crystalline dextrose is chemical engineering industry of large and rapidly increasing proportions

By Lionel K. Arnold
Chemical Engineering Department, Iowa State College

CORN is one of the greatest raw materials of the plant world available to the chemical engineer. Although the corn products industries of the country consume approximately 70,000,000 bushels of corn annually, converting it into products valued (1923) at over $116,000,000, this represents a consumption of but 2.5 per cent of the total crop. This immense resource available every year provides adequate material for vastly greater industries.

The development of the present process for the manufacture of refined crystalline dextrose from corn starch is especially interesting from the standpoint of chemical engineering technology. The refined corn sugar is manufactured by the Corn Products Refining Co. at Argo, Ill., under patents granted to W. B. Newkirk on a process developed in the laboratories of the company at Edgewater, N. J. A similar product is being made by Penick & Ford, Ltd., Cedar Rapids, Iowa; Clinton Corn Syrup Refining Co., Clinton, Iowa; and American Maize Products Co., Robey, Indiana.

The general method of producing dextrose by the hydrolysis of starch in the presence of a small amount of acid according to the empirical equation

$$(C_6H_{10}O_5)_n + n(H_2O) \rightarrow n(C_6H_{12}O_6)$$

has been familiar to the chemist since its discovery by Kirchoff in 1811. As other materials from the corn under the influence of acid and heat form a disagreeable color and taste in the resulting syrup, the starch must be as free from impurities as is practicable. Careful washing on the tables and in the filters is considered sufficient for this purpose in some plants. Others, as Penick & Ford [Widener (*Chem. Bull.*, 1924, vol. 11, p. 144)], treat the starch with enzymes, which convert the insoluble proteins into soluble ones that can be washed out.

The starch as used in the refinery for refined corn sugar is a water suspension of approximately 12 deg. Bé., as contrasted with 20 deg. to 22 deg. Bé. for syrup and 18 deg. for some of the cruder sugars. Conversion is usually carried out in bronze converters having a capacity of 2,200 gal. About 100 lb. of commercial hydrochloric acid is added to each converter of starch. The time of conversion depends upon the pressure used and this varies in different plants, the starch being sometimes partly hydrolyzed in large wooden tanks by the injection of live steam before going to the converter. To determine when the conversion is complete, a sample of the liquor from the converter is tested by the addition of alcohol, any dextrin or starch present being precipitated out. After a satisfactory test showing no dextrin or starch present, the cooking is continued for about 15 min. to insure complete conversion. With the ordinary operating pressures of 40 to 45 lb. the proper test is obtained in 13 to 14 min., giving a total conversion time of 28 to 29 min.

When conversion is complete, the liquor is blown up to large wooden tanks known as "neutralizers." To neutralize the acid, about 40 lb. of soda ash is added, and the mass thoroughly stirred. The resulting acidity, which is usually held between 0.01 and 0.02 per cent, must be carefully controlled to obtain proper filtration and to prevent decomposition of the dextrose due to the alkalinity.

The liquor is now run through centrifugal separators to remove any oily matter and through filter presses to remove solid matter such as starch protein and fiber. It is then filtered through bone char contained in large cast-iron cylinders such as are used in the cane-sugar industry. Some plants are, however, using instead of bone char the vegetable carbon decolorizers sold under various trade names for sugar syrup filtration. Both types of material give good results if properly handled. After filtration the liquor is evaporated to 30 deg. Bé. in regular triple-effect sugar evaporators. After another filtration through bone char or vegetable carbon, the liquor is evaporated to 40 deg. Bé. in a single-effect vacuum pan and is ready to be crystallized.

The ordinary yellow sugar is produced by allowing the sugar liquor to crystallize into a solid mass which can be sold in slabs or made into chipped sugar. Under the process developed by Charles Ebert and used by the Corn Products Refining Co., the slabs are pressed to remove a portion of the mother liquor, thus giving a lighter colored and better tasting sugar much used in the manufacture of bread, pancake flour, and to some extent in ice cream. Prior to the development of the present refined corn sugar, a pure product was made in small quantities by the Corn Products Refining Co. at the Edgewater plant by recrystallizing pressed corn sugar, centrifuging out the "greens," drying and pulverizing [Porst, Mumford and Nichols (*J. Ind. Eng. Chem.*, 1922, vol. 14, p. 217)]. The resulting product had a purity (per cent dextrose on dry basis) of 99.9.

Crystallization Must Be Controlled Carefully

To produce refined corn sugar it is necessary to form the crystals under such conditions as to produce a grain of uniform size and shape that can be centrifuged efficiently. Unfortunately, there are three types of dextrose hydrate crystals formed [Newkirk (*Ind. Eng. Chem.*, 1924, vol. 16, p. 1173)]. One type consists of a group of elongated needle-like crystals, which, starting from a common point, twin and retwin, forming the wartlike masses often mentioned in the older literature. It is impossible to purge these successfully and they were probably the cause of many of the early failures. Another type consists of single elongated needle-like crystals, which break up into small pieces, forming an impervious mat on the centrifugal screen. These crystals are especially common in the more impure massecuite (magma of crystals in mother liquor or greens), such as second sugar. The third type is the characteristic flat hexagonal plate-like crystal which, if uniform in size and not enough soft to break up too easily, is readily purged in the centrifuge. Anhydrous dextrose crystallizes in elongated prisms of the rhombic system.

It is obvious that for proper centrifuging the crystals must not only be of the same kind but also of the same size, preferably not too small. If they consist of different sizes in the same massecuite, they will pack together in such manner as to form an impervious layer on the centrifugal screen, thus preventing practical purging.

The necessity for agitation and holding at a definite temperature in order to produce uniform crystals was recognized as early as 1881 by Horace Williams, who was granted a patent (U. S. Patent No. 240,796) providing for rapid agitation by a propeller type of agitator in a water-cooled, conical-bottomed, vertical tank. Williams provided for crystallization with rapid agitation, but T. B. Wagner in 1906 (U. S. Patent No. 835,145) specified agitator speeds varying from 1 r.p.m. to 1 every 5 min. The latter is the speed now used. In 1886 Soxhlet (U. S. Patent No. 335,044) specified the proper gravity of the liquor as 36.5 deg. Bé. measured at 194 deg. F., crystallization to take place after cooling to 95 deg. F. He emphasizes the fact that efficient crystallization temperatures vary with the gravity of the liquor.

Newkirk (U. S. Patent No. 1,471,347 and 1,508,567) gives 100 deg. F. as the proper crystallization temperature for 40 deg. Bé. liquor. (See also U. S. Patents No. 1,521,829; 1,521,830; and 1,571,212.) This figure as is customary in corn sugar practice, is for the gravity as measured at 100 deg. F., proper correction being applied if measured at a different temperature. This agrees very closely with that given by Soxhlet when the latter is corrected to the 100-deg.-F. basis (36.5 deg. Bé. at 194 deg. F. being equal to approximately 40 deg. Bé. at 100 deg. F.). Newkirk also specifies that if the temperature of crystallization is held between 110 deg. F. and 120 deg. F. with the same gravity, anhydrous crystal will be formed provided the liquor is seeded with anhydrous crystals.

In actual practice, the liquor of a gravity of approximately 40 deg. Bé. (on 100-deg.-F. basis) is cooled from the pan temperature of about 140 deg. F. to about 125 deg. F. in conical-bottomed, vertical tanks. It is then pumped into crystallizers of the type used in cane and beet sugar industries. These are horizontal cylindrical tanks, about 9 ft. in dia. and 20 ft. long, equipped with slow-moving spiral agitators and with water jackets. Each crystallizer contains about one-third of its capacity in massecuite from the previous crystallization as seed. Dry seeding with the finished product is possible but usually gives a small grain which is unsatisfactory. The temperatures given above for proper crystallization are not rigidly followed but are varied according to the judgment of the operator so as to produce the required size of grain. The exact behavior of a batch of liquor under given conditions of gravity, temperature, seeding, and agitation cannot be determined in advance. Two batches identical as to laboratory tests of purity (per cent reducing sugar of total dissolved matter or dry substance) and gravity, seeded with the same kind and amount of seed and agitated at the same speed, may require different temperature control to produce similar amount and size of crystals in the massecuite.

The usual time required for crystallizing is about 72 hr. At the end of this time, the massecuite is dropped to the mixer at the centrifugal machines for purging. The mixer, as in beet and cane sugar plants, is a U-shaped steel tank equipped with a slow-moving agitator. Regulating gates or valves are provided at each machine through which to load it with massecuite. The centrifugals are standard sugar machines with automatic washers and fiber-tipped unloaders. The purging of corn sugar is somewhat slower than beet sugar, as lighter loads and longer operating time are necessary. However, automatic washers may be used to good advantage, so that one man can easily operate 10 machines, dumping and refilling the battery of 10 machines about every 45 min. As dextrose packs in a denser layer than sucrose, it has more of a filtering action on the wash water. For this reason, the water must be absolutely free from suspended matter, as this will be filtered out in the form of a troublesome gray layer on the inner side of the cake of sugar. Iron-bearing waters stain the sugar a disagreeable color. Dextrose crystallizes relatively slowly so that the proportion of crystals in the massecuite dropped to the mixer from a given crystallizer does not appreciably vary during the time necessary for centrifuging.

Drying Is More Difficult Than with Cane Sugar

After washing until white and centrifuging as dry as is practicable, the sugar is conveyed in spiral-ribbon conveyors to a sugar drier of the usual revolving-drum type heated by steam coils at one end. The drying air is blown through by fans or blowers and discharged

to the outside of the building through dust collectors. The latter are circular in shape and provided with a baffle and steam sprays to throw out any sugar dust carried over. Certain physical properties of dextrose crystals necessitate modifications in the drying process from that used in the beet and cane sugar industries. The flat plate-like crystals of dextrose are more difficult to dry than the cubical sucrose crystals, requiring greater drier capacity. The greater tendency to break up, producing large amounts of fine material, interferes seriously with counter-current drying, since the fine dusty material is blown back from the discharge end. One method of drying is to use two driers in series with the air current in the second drier running parallel to the flow of the sugar, and the same air current running through the first drier counter-current to the sugar flow. This method is very satisfactory. The final moisture is about 8 per cent.

Vibrating Screens Used to Separate Fines

After drying, any coarse material is screened out, crushed in a roll crusher, and returned to the upper drier. Revolving screens were first used for screening, but vibrating screens of the Hummer type were found to be more satisfactory. From the screen the sugar drops directly into the hopper or bin from which it is packed into bags. If powdered sugar is desired, the powdered portion of the regular sugar is screened out, using fine-mesh Hummers.

The yield of finished sugar is 40 to 45 per cent of the total dry substance in solution in the converted liquor, or from 34 to 38 per cent of the total weight of the liquor. About 90 per cent of the dry substance dissolved in the original liquor is dextrose, that is, it has a "purity" of 90. This purity is ordinarily determined by the use of Fehling's solution according to the standard method for reducing sugars. The determination of dry substance for purity calculations is made by determining the gravity of the solution with a Brix hydrometer as in apparent purity determinations of sucrose syrups.

Crystallization of Second Sugar Is Slow Process

In addition to the crystallized sugar, there comes from the centrifugal machines the mother liquor or greens of purity from 76 to 82, containing dissolved material amounting to 38 to 43 per cent of the original dry substance in solution in the original liquor. The wash-water dry substance amounts to 9 to 15 per cent of the original dry substance and has a purity of 88 to 92. Obviously, the wash water could be added to the liquor from the converters in a manner similar to that in the sucrose industries, and this is actually done. If standard sucrose practice were followed, the greens would be reboiled and crystallized to separate a second sugar. This is the process followed by the Corn Products Refining Co. and is a prominent feature of their patents. The greens are filtered through bone char, evaporated to the same gravity as first sugar liquor, and crystallized in the same manner as for first sugar. Due to concentration of impurities in the mother liquor, the crystallization proceeds more slowly, requiring two to four weeks. As the liquor during crystallization is not artificially warmed above room temperature, the large part of the crystallization will take place at a lower temperature than the specified 100 deg. F. The crystals produced are usually smaller than from the first crystallization and are often mixed with a long needle-like variety. The second sugar is usually centrifuged to remove the second greens or hydrol but not washed.

The second sugar varies from a light yellow sugar to a dark sticky mass of sugar and greens, depending upon, as yet, unknown factors. It is mixed with wash water from the first sugar and dissolved by heating with steam. The resulting syrup is added to the newly converted liquor used for first sugar production. By this process about 25 lb. of finished sugar is produced from a bushed of corn. The hydrol, or second sugar greens, has a purity from 65 to 70 and can be reboiled and crystallized, but this is not usually considered an economical procedure. It is also possible to crystallize some sugar by merely allowing the hydrol to stand in storage tanks for several months. It is usually sold for stock feeding or tanning purposes as its bitter taste makes it unsuited for human consumption. A small amount is sometimes mixed in with the gluten stock feed.

Refined corn sugar is differentiated from sucrose by certain properties which affect its commercial utilization. While a crystalline sugar, it crystallizes, as has been pointed out, in rather soft, flat, plate-like crystals quite different in appearance from the hard cubical sucrose crystals. Due to their shape and softness, there is more breaking up in drying and packing dextrose, than with sucrose, so that it usually contains considerable powder. Dextrose is less sweet than sucrose, being quite commonly rated 60 per cent as sweet. However, recent work at the University of Minnesota by Biester, Wood and Wahlin (*Am. Jour. Phys.*, 1925, vol. 73, p. 387) assigns a value of 74 per cent for the anhydrous sugar. As the commercial sugar is usually a mixture of the hydrated and anhydrous sugar in proportions to give a moisture content of about 8 per cent, it would be less sweet than this. Having a specific gravity of about four-fifths that of sucrose, the commercial sugar is about 54 per cent as sweet when measured by volume. Although the lower sweetening value decreases its desirability for most domestic purposes, it is an advantage to the ice cream manufacturer since it gives the desired body and smoothness to his product without excessive sweetness. It is also advocated for canned fruits and condensed milk, as in solution it has a higher osmotic pressure and consequently a greater preserving power than sucrose without excessive sweetness, which often detracts from the actual fruit flavors. Since it does not have to be hydrolyzed before assimilation, it has been advocated for use in certain diseases. For the same reason it forms better food for yeasts, and hence is extensively used by bakeries for bread making. Dextrose in candy crystallizes in minute crystals and tends, when mixed with sucrose, to decrease its crystal size and so is used to prevent "sugaring." Because of its low caramelizing point, it is used by the makers of pancake flour to give a brown color to the finished product. The use of corn sugar in cooking has recently received attention from the home economics departments of the larger colleges and universities, especially in the corn belt, and gives promise of wider use according to *Home Economics Bull.* No. 92. Iowa State College. It is evident that corn sugar will not entirely replace cane or beet sugar, but it has certain distinctive and valuable uses in which it is superior, and no doubt other uses will be developed as its advantages become more widely known.

Economics of the Chlorine Industry

In electrolytic process, chlorine is principal product, caustic soda and hydrogen being byproducts

By D. A. Pritchard
Works Manager, Canadian Salt Company, Ltd.

THE modern chlorine industry, like other chemical enterprises, is greatly indebted to the science of the late eighteenth and early nineteenth centuries. In 1774, Scheele prepared gaseous chlorine by the action of hydrochloric acid on manganese dioxide. Northmore prepared the first liquid chlorine in 1805. In 1807 Sir Humphrey Davey produced sodium and potassium by the decomposition of fused salts with an electric current, and in 1810 demonstrated that chlorine is an element, discarding the old name of the gas, "oxygenated or phlogistonated muriatic acid," gave the name "chlorine" and sealed the doom of the phlogiston theories. In 1833, Michael Faraday discovered and set forth the laws for the action of electric current on salt solutions.

The history of the economics of chlorine begins in 1785, when Berthollet prepared a bleaching agent by dissolving gaseous non-electrolytic chlorine in water. In 1789 he improved this process by adding the chlorine to caustic potash solution at a French chemical plant on the Quai de Javelle, Paris, and this new bleaching agent became known as "Eau de Javelle." James Watt, the chemist and inventor of the steam engine, obtained the process of manufacture of "Eau de Javelle" from Berthollet and handed it on to Charles Tennant, the founder of the great English chemical company. After long study, Tennant brought out in 1798 a bleaching solution made by chlorinating milk of lime, and in 1799 improved upon this substance by chlorinating hydrate of lime. Thus the bleaching powder industry was born.

The bleaching powder business grew from 1799 on, but the manufacture of gaseous chlorine by the Berthollet method of heating salt, manganese and sulphuric acid in lead stills continued to be the method of chlorine production, until 1836, when Gossage invented his coke towers for the condensation of the waste hydrochloric acid gas evolved in the LeBlanc soda process. Once that was accomplished, Scheele's invention of 1744, the evolution of chlorine from the reaction of hydrochloric acid on manganese dioxide, became largely the commercial method of producing gaseous chlorine.

However, in 1845, Dunlop invented a process of preparing chlorine by decomposing salt and potassium nitrate with sulphuric acid. The process gave hydrochloric acid and nitrous oxides as byproducts. The chlorine was freed from hydrochloric acid by washing with water, and the nitrous oxides were absorbed by sulphuric acid and used in the production of sulphuric acid. This process was only commercially possible when tied in with sulphuric acid manufacture, and, aside from Tennant's, does not appear to have been used elsewhere on any considerable scale.

In 1855 Dunlop invented a process for Tennant whereby he recovered and regenerated the waste manganese liquors of the Scheele method, and in 1866 and later, Weldon improved substantially on the Dunlop process. In 1868, Deacon and Hurter obtained British patent No. 1,403, covering the well-known Deacon process of producing chlorine by decomposing hydrochloric acid with oxygen in the presence of an oxygen carrier. The Deacon process became the outstanding one, though many attempts were made by inventors to improve upon it, and also to obtain chlorine from the byproduct calcium chloride of the Solvay soda process. The gradual rise of the Solvay soda process and the decline of the Le Blanc soda process, and the advent of electrolytic chlorine make the Deacon process now a matter of history.

In 1851, Charles Watt obtained British patent No. 13,755, covering an electrolytic production of chlorine, caustic soda, sodium hypochlorite, etc. This patent is of great historical interest, and was followed by those of other inventors, and much research was done in Germany and England. In 1884 the Elektron Co., Griesheim, began investigations of electrolytic chlorine production, and in 1890 this company started the first successful commercial manufacture in the world. From 1890 onward numerous cell installations of many types were started. Some worked, and others did not, but the progress was steady. In North America at least 14 types of cells are in use at present.

While these gradual changes in the methods of producing gaseous chlorine were going on, the uses of bleaching powder steadily increased in the bleaching of textiles and paper pulps, in crude methods of disinfection, and after 1856 the industry obtained a new consumer in the coal-tar dyestuff industry in England and Europe. England built up a world-wide market in bleaching powder. Germany also had a large domestic and some foreign business. Liquid chlorine, however, brought about in Germany and in the United States, and later in England, a rapid growth in electrolytic plants without a corresponding growth in uses. This condition obtains now in Germany, Italy, England and the United States.

The chlorine industry here and abroad is primarily concerned in making chlorine and finding uses for it. The industry cannot make caustic soda, and waste chlorine and hydrogen. The amount of misinformation about the economic status of chlorine is considerable, and presumably well-informed chemists and engineers have hazy ideas on the subject. Works of reference, especially English ones, contain little about liquid chlorine and much about bleaching powder. Two recent and on the whole excellent treatises on chlorine cells made no mention of the cell used in one of the largest cell installations in the world.

It is not unusual to hear that chlorine is incident to the manufacture of soda and caustic potash. A recent trade paper in an article on chlorine said in part: "At

Paper presented at the Forty-Ninth General Meeting of the American Electrochemical Society held in Chicago, April 22, 23 and 24, 1926.

present the output from the manufacture of caustic soda and caustic potash far exceeds the current demand. About 30 per cent of the output is lost or disposed of in some way so as not to be a nuisance to the surrounding country. . . . The consumption of chlorine is increasing now, but apparently no faster than that of its twin product, caustic soda." The answer to all such statements as this is that electrolytic caustic soda and caustic potash, so far as the chlorine industry is concerned, are incident to the manufacture of chlorine. Electrolytic caustic soda is a small part of the caustic soda made and consumed, and the use of caustic potash tends to decline, because the cheaper caustic soda replaces it in many operations.

Local Production of Chlorine Impracticable

It is often said that cell operation is a simple thing, and that chlorine consumers can easily and cheaply produce their needs on the spot. If this were true the chlorine industry here and abroad would have largely disappeared years ago. It must be obvious that most users of both chlorine and caustic soda need far more soda than chlorine, and that to make enough soda they are bound to produce within two or three per cent of the same amount of gaseous chlorine. What will they do with this chlorine? It cannot be put into the air or the sewer with impunity, and it cannot be sold in gaseous form. So three methods of disposal are at their command—(1) make bleaching powder for a dwindling market; (2) liquefy it and become part of an overdone industry; (3) engage in the highly competitive, and in the present state of our knowledge, somewhat restricted manufacture of organic and inorganic compounds of chlorine. All three ways out of this dilemma are economically unsound, and are a hopeless task for a chlorine consumer, who incident to his operations, requires some caustic soda and much less chlorine. In the chlorine industry proper the capital investment is two dollars for each one dollar of sales annually. This capital investment, although no higher than that of some other parts of the chemical industry, is about double that of the average of all manufacturing enterprises.

Again, let us suppose that a user of both chlorine and caustic soda elects to make chlorine to the extent of his needs, and to supplement his electrolytic soda with purchased soda. It is immaterial whether he buys this soda fused in drums or in liquid form, he must so arrange matters that his weak cell liquors are mixed with the purchased soda to give him the strength or strengths of soda solution necessary for his operations. This is not as simple as it sounds, and again he is embarked on a chemical enterprise requiring constant and expert attention, especially if sodium chloride is present in his own cell liquors, and as is generally the case, is detrimental to his technical use of the soda.

Again it is often urged that small users of sodium hypochlorite solutions can best make such solutions at the cell itself. There are a number of small operations of this kind, and they perform fairly well if given expert attention. It is often claimed that such sodium hypochlorite solutions are more stable, and give "quicker bleaching effects" than solutions made up from bleaching powder or liquid chlorine, together with soda ash and caustic soda. The fact is that an absolutely stable sodium hypochlorite solution is yet to be had by any known method of manufacture. Once that is attained it will be possible to measure this "quick bleaching effect" of various hypochlorites.

Over and above all of the foregoing considerations still remain two important features, the disposal of the hydrogen, and the technic of cell operation. The hydrogen matter will be touched upon later.

As to cell operation, it must be evident from the foregoing historical sketch that the comparatively successful cell operations of various types of today are the flower of many years of work and the expenditure of much money. The cells are still a delicate mechanism requiring expert chemical and mechanical supervision. It is a 24-hr. day operation in three 8-hour shifts, seven days a week. Each shift requires skilled foremen and chemical control. You cannot turn production on and off as you do a water tap. You are dealing simultaneously with three substances requiring most careful handling —a noxious gas, a flammable gas, and a powerful alkali.

A central plant serving a large number of customers is in a good position to obtain steady distribution of its diverse products, and so keep its production constant with consequent economy of operation.

Until recently hydrogen has been largely wasted by chlorine makers in the United States of America, and to a lesser extent abroad. The current and proposed uses are for the manufacture of hydrochloric acid, ammonia, alcohols, and the hydrogenation of oils. A little has been used at times for balloons, but lighter-than-air flying machines cut little figure in military aeronautics, and in the United States helium has displaced hydrogen. Small quantities of hydrogen are also burned for heating purposes in some chlorine plants.

As to hydrochloric acid, the manufacture by combining hydrogen with chlorine gas has been practised on a commercial scale for some years, both here and abroad. The first American production was by Roberts Chemical Co., Niagara Falls, N. Y., in 1902. It is admittedly a somewhat hazardous enterprise on account of explosion risks. The acid is of high purity, providing suitable absorption apparatus is used. There is also considerable acid made by a process requiring the passage of chlorine and steam through coke, which is first brought to glowing heat and afterwards kept hot by the temperature of the reaction. The real difficulty in the United States and Canada is to dispose of the acid in competition with sulphuric acid. Hydrochloric acid will readily replace sulphuric acid at a price in numerous operations, including the bleaching of cotton textiles and the pickling of steel plates, and is used abroad in large quantities for such purposes. Abroad, in the pickling of steel plates, ferrous chloride is obtained as a byproduct, and this is in turn converted to ferric chloride and furnishes a cheap source for the last-named material.

Synthetic Ammonia As An Outlet for Hydrogen

Chlorine cell hydrogen, which is very pure, fits admirably into the manufacture of synthetic anhydrous ammonia, and nearly all of the hydrogen not used for other purposes and now available from this source at Niagara Falls is tied in to synthetic ammonia operations. There is at least one chlorine maker outside of Niagara Falls using his hydrogen for synthetic anhydrous ammonia manufacture, and several others are building or contemplating building small ammonia installations. It is not to be inferred, however, that

synthetic anhydrous ammonia manufacture will bring about an increase in chlorine production in order to obtain pure hydrogen, but to the extent that chlorine cell hydrogen is nearby to synthetic ammonia operations, it offers some cheap and pure supply of the key to the production of both synthetic ammonia and synthetic alcohols.

Attention should be called to the fact that the total production of anhydrous ammonia, synthetic and non-synthetic, in the United States has already outstripped the consumption. Unless new uses or conversion to ammonium sulphate or other fertilizers or oxidation to nitric acid for the increasing use of nitric acid in nitrocellulose for rayon and lacquers can be had, the further expansion of synthetic ammonia in the United States at least, is a problem of matching costs with non-synthetic ammonia. We cannot, however, engage in this paper in speculations on the cost of production of non-synthetic ammonia, or foresee the future. It is worthy of note that synthetic ammonia, as matters stand now, is a purer product than its rival, and has already found interesting technical applications and tends so far to create a field of its own. In passing to the next use of chlorine cell hydrogen, it should be noted that isolated chlorine cell operations outside of the chlorine industry, wasting their hydrogen, are at a further disadvantage in chlorine costs of about $4.50 per ton of chlorine, by reason of this wastage.

Chlorine cell hydrogen for synthetic alcohol manufacture has been proposed, but nothing appears to have been done here or abroad so far. The same economic considerations as in the case of synthetic ammonia are in order, that is, it does not appear to be possible in the present state of our knowledge to build a synthetic alcohol operation on chlorine cell hydrogen, without first having a sure and profitable outlet for the chlorine.

Chlorine cell hydrogen for the hydrogenation of oils is really a simple matter, and resolves itself into a transportation question. It takes very little hydrogen and much oil to get a hard fat. You cannot transport the hydrogen any great distance, so the oil must be brought to the chlorine cell hydrogen if that is the hydrogen to be used. As chlorine cell hydrogen in the United States is remote from the oil supply, the matter is largely academic. One American chlorine maker hydrogenates oils and carries every operation from growing the oil nuts to disposing of the nut residues as cattle feed.

Bleaching Powder Has Traditional Background

As before stated, bleaching powder was made in England from 1799 onward. The lime, then and now mainly a carrier for the chlorine, took on an added importance in this compound in the eyes of bleachers of textiles, and a great tradition was built up that the lime played a necessary part in textile bleaching operations. This tradition, born of the use of lime boiling and other lime treatments of textiles long prior to the use of chlorine as a bleaching agent, persists to this day, especially in England. The use of bleaching powder in textile processes in Germany and the United States is obsolete except for small scale operations. As the Le Blanc soda process was never operated in the United States or in Canada, neither country had any chlorine by the Deacon method, and there is no record of American or Canadian commercial production of chlorine by the method prior to Deacon mentioned above. The United States and Canada therefore imported bleaching powder largely from England, and not in quantities until after the Civil War, as the consuming industries were few and took little.

The first Canadian manufacture of bleaching powder was by Canadian Salt Co., Ltd., Windsor, Ont., in 1912. The first manufacture of bleaching powder for sale in the United States was at Rumford Falls, Me., in February, 1893. This was the first American electrolytic chlorine plant and used the LeSueur cell. At Midland, Mich., at what is now The Dow Chemical Co., small quantities of bleaching powder were made as early as 1895, and on Thanksgiving Day, 1897, The Dow Chemical Co. started a larger plant, using 400 kw. In 1898 the Rumford Falls LeSueur cell plant, then known as Electrochemical Co., was transferred to the works of the Burgess Sulphite Fibre Co., at Berlin, N. H., and in the same year the Castner Electrolytic Alkali Co. began making bleaching powder at Niagara Falls. The Pennsylvania Salt Manufacturing Co. at Wyandotte, Mich., started in 1903, followed by Hooker Electrochemical Co. in 1906. From thence on, other manufacturers added to the bleach output, and in 1916, the high-water mark for bleaching powder was reached when the American production for sale exceeded 133,000 short tons.

Liquid Chlorine Steadily Replacing Powder

The imports into the United States were at their highest in 1891, two years before LeSueur started, and amounted to 55,578 tons. In 1913 they had dropped to 38,000 tons and in 1924 were 5,400 tons. In 1924 the American and Canadian production for sale was about 83,000 tons. No reliable figures for American or Canadian export are available, but obviously the production is declining as liquid chlorine gradually replaces bleaching powder. It is interesting to note that the declared value for customs entry purposes in the United States of imports in 1871 averaged $39.60 per short ton. The American price now is $40 per short ton with the dollar at a purchasing power as compared with the dollar of 1871 of about $0.50. In other words, the selling price of bleaching powder is about one-half of what it was in 1871.

Bleaching powder will undoubtedly continue to be made in the United States and Canada on a modest scale for years to come, until the traditional uses die out, and all chlorine users become expert in the application of liquid chlorine. In small quantities bleaching powder now competes with liquid chlorine on a strictly cost basis, because of the expensive packaging of liquid chlorine. Technically considered, bleaching powder offers no advantages over liquid chlorine, as the absence of lime residues, the ease and mobility of handling, and the fact that lime is not always required in the technical application, are all in favor of liquid chlorine. Furthermore, liquid chlorine properly packaged and stored in a cool place will last indefinitely, whereas both bleach and its packages deteriorate.

Liquid chlorine was first commercially produced in 1888 by the Badische Co., and it will be noted that this was two years prior to the commercial operation of the first electrolytic chlorine plant in the world at Griesheim. From 1888 onward the manufacture of liquid chlorine has been highly developed in Germany. The English stuck to bleaching powder, and had no considerable liquid chlorine until after the World War had

started. The first Canadian liquid chlorine was manufactured by the Canadian Salt Co., Ltd., Windsor, Ont., in 1922.

In the United States the first commercial delivery of liquefied chlorine in cylinders was made in 1909. In that year the Goldschmidt Detinning Co. of Wyandotte, Mich., shipped the first American 15-ton single tank carload of liquid chlorine to their plant at Carteret, N. J. The liquid chlorine business grew slowly but steadily, largely due to the pioneer work of E. D. Kingsley, of the Electro Bleaching Gas Co., in the bleaching of cotton textiles and the treatment of potable water supplies. The estimated yearly capacity of all commercial plants in the United States and Canada in 1925 was approximately 185,000 tons of chlorine gas, and of this capacity approximately 46,000 tons were liquefied. What proportion of the total gas capacity and total liquefying capacity was operated in 1925 is not known, but it is certain that a large proportion of both was not operated. These figures do not include Edgewood Arsenal, Md., the U. S. Army plant, with a chlorine gas capacity of 36,500 tons. This plant does not operate and is held in standby condition.

The packaging and transportation of liquid chlorine has been brought up to a high standard. It is transported steadily and with almost complete absence of accident in single unit 15-ton steel tank cars, in multi-unit steel cars, carrying 15 one-ton tanks, and in steel cylinders of 10, 20, 100, 150 and 2,000 lb. (4.5, 9.1, 45, 68 and 907 kg.) capacity. There are over 300 steel tank cars and 80,000 steel cylinders in use or available. The United States shipping regulations are embraced in "I. C. C. Regulations for the Transportation of Explosives and Other Dangerous Articles by Freight and Express and as Baggage, Including Specifications for Shipping Containers, Bureau of Explosives, Pamphlet No. 9, Effective Jan. 1, 1923. Par. A, 551, 559, 562C, 576, 581 (6), 582, 583, 917." The Canadian regulations are modeled exactly on the aforementioned regulations. This packaging requires a large capital outlay, and the shippers keep elaborate and costly records of every container, and maintain a rigorous inspection of every container prior to filling. These items add measurably to the cost of producing liquid chlorine. The makers are also obliged to maintain an expert service as technical assistance to consumers.

Paper Industry Largest User of Chlorine

It is estimated that about 65 per cent of all the chlorine gas manufactured in the United States and Canada is consumed by the paper industry; that 22 per cent is used in the textile industries; 10 per cent in sanitation and the remaining 3 per cent in all other uses.

Liquid chlorine is transported to over 6,000 cities and towns in North America for the chlorination of drinking water, sewage, bathing beaches, swimming pools, garbage odors, and for other sanitary purposes. The application of chlorine to such uses has been evolved from the pioneer stages to a high standard, by much hard work and research. American and Canadian chlorine sanitation is the model for the civilized world. However, much remains to be done in the sanitary field, especially in sewage, which becomes an increasingly difficult matter with the growth of cities, the mobility of the population brought about by the motor car, the progressive deforestation of the American continent, the increase in industrial wastes, and the enormous per capita consumption of water. Chlorine is not a "cure-all" for the sewage problem, but that it has a place in treatments of various kinds, is increasingly evident. Gaseous chlorine for the treatment of colds and diseases of the respiratory tract has recently been used in thousands of cases with good results as a whole and much research is under way.

Chlorine-Resistant Materials Needed

These "all other uses" are largely within the field of organic synthesis, or the treatment of organic substances. First as to organic synthesis. It is well known that there are numerous processes involving chlorine in some form, and that they are practiced as in the cases of paradichlorbenzene, trichlorethylene, etc. The field, however, in the present state of knowledge, is limited by the fact that there is so far no available metal or other substance which has the ruggedness of material now employed in organic synthesis, plus the necessary resistance to the corrosive action of wet chlorine gas and hydrochloric acid. The search for such substances is one of the present problems of the industry. In the treatment of organic substances, such as petroleum, considerable progress has been made in recent years, but the side reactions set up are troublesome.

The use of chlorine compounds as solvents increases slowly in North America, because they cannot compete with gasoline or solvent naphtha in price, and price outweighs considerations of safety. Most of the chlorine solvents are not flammable, and have a low, if any, electrical conductivity. Furthermore, as compared with Europe and England, little wool grease is recovered in North American woolen mills, and where it is recovered solvent naphtha in closed systems is used. Europe has built up a good technic in the recovery of wool grease, etc., with chlorine compounds. The chlorine solvents have varying degrees of stability, and this tends to restrict their use where moisture and heat are present, because if they break down and form hydrochloric acid, corrosion, unless checked, sets in. The principal chlorine solvent now in use is carbon tetrachloride, the well-known fire-fighting fluid of hand fire extinguishers.

No discussion of the economics of chlorine is complete without reference to the large part that chlorine played in the poison gas warfare of the World War. What will come about in the unhappy event of more war is a matter of prophecy, but the fact remains that a going commercial manufacture of chlorine in times of peace for the industrial arts, the sciences and the health of a nation, is a constant element of military preparedness at no expense to the taxpayer.

We have tried in the foregoing remarks to outline as briefly as possible something of the history and economics of chlorine. To sum it all up in a sentence or so, the manufacture is a difficult enterprise, quite overdone by reason of the restricted uses of chlorine and the fascination which the electrochemical industry works on the mind of man. The industry in North America has had to manufacture and sell cheaply, find markets and new uses, switch largely from bleaching powder to liquid chlorine, provide technical service, and adjust more or less imperfectly the economics of three distinct substances evolved in one major operation to a rapidly changing industrial structure. A capacity bearing a reasonable relation to consumption, a decent return on its capital and the continuance of research are essential to this key industry.

Indurating Wood With Sulphur

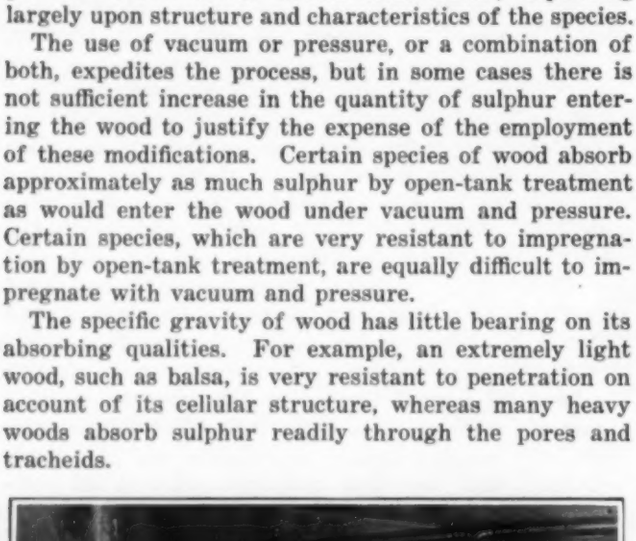
Absorption of molten brimstone preserves wood, hardens and strengthens it and gives acid-resisting properties

By William H. Kobbé
Consulting Engineer, Texas Gulf Sulphur Co., National Sulphur Co., New York City, N. Y.

INDURATING wood with sulphur is a rather recent development in which there appears to be considerable interest, notwithstanding the fact that many tests will have to be made to determine the properties imparted by the treatment. Practically all woods may be impregnated by immersion in molten sulphur by a simple open-tank treatment, and the quantity of sulphur absorbed varies within wide limits, depending largely upon structure and characteristics of the species.

The use of vacuum or pressure, or a combination of both, expedites the process, but in some cases there is not sufficient increase in the quantity of sulphur entering the wood to justify the expense of the employment of these modifications. Certain species of wood absorb approximately as much sulphur by open-tank treatment as would enter the wood under vacuum and pressure. Certain species, which are very resistant to impregnation by open-tank treatment, are equally difficult to impregnate with vacuum and pressure.

The specific gravity of wood has little bearing on its absorbing qualities. For example, an extremely light wood, such as balsa, is very resistant to penetration on account of its cellular structure, whereas many heavy woods absorb sulphur readily through the pores and tracheids.



Sulphur Impregnating Cylinder and Supply Tank
Experimental equipment in the tie treating plant of the Santa Fé Railway at Somerville, Texas

The writer has experimented with white pine, sugar or western white pine, red and white palmetto, so-called soft and hard California redwood, poplar, cypress, white wood (Lierodendron tulipifera), hard maple, beech, birch, red oak, white spruce, cedar and other species. These include the various types of woody growth such as hardwood or broadleaved species, soft woods or conifers, and the palms.

The wood is generally immersed and held beneath the surface of the sulphur bath, which is maintained at a temperature of 140 to 150 deg. C. for the first 5 or 6 hours, or until all evidence of moisture has disappeared. It is then advisable to allow the temperature to drop to 120 or 125 deg. for the remainder of the time, or 4 or 5 hours, when the wood is removed. The extent of penetration is generally evidenced by the buoyancy of the wood in the sulphur bath and also by complete cessation of bubbling. A fully impregnated piece of white pine will expose only about one-fifth of its volume above the surface of the sulphur and will, of course, sink in water.

The period of immersion depends upon many factors, but in general the various woods are left in for not less than 10 or 12 hours and in some cases double this time has little effect upon the total quantity absorbed. A readily impregnated wood may require only 4 or 5 hours but in all experiments to date, an effort has been made to secure maximum impregnation irrespective of the time element, in order to determine just what woods may be treated by open-tank methods and the portion of the tree best adapted for this purpose.

An important feature of the process is the control of temperature and time. The writer seldom allows the temperature to fall below 120 deg. or rise above 150 deg. C. and finds that it is entirely unnecessary to carbonize or even partially carbonize the wood in order to produce a material which sulphur will penetrate.

California redwood absorbs approximately its own weight of sulphur, while Florida palmetto absorbs about the same as white pine, or from 60 to 70 per cent, but requires a much longer period of immersion. The other species of wood mentioned absorb anywhere from 5 or 6 per cent up to 50 per cent or more, depending upon the conditions and structure of the wood. The following table indicates the percentage of sulphur absorbed by certain woods:

	Per Cent		Per Cent
California Redwood	50	White Pine	75
Poplar	76	Sugar Pine	75
Cypress	60	Red Oak	40
White Spruce	64	White Wood or N. C. Poplar	40

It is advisable to treat seasoned wood, because the presence of moisture inhibits the penetration of sulphur and when in excess, prevents the entry of practically any sulphur. This may be explained by the fact that it is difficult for the sulphur to enter the

tracheids, pores or resin ducts while moisture is being driven off in the form of steam, and in addition, the conversion of water to steam requires a certain number of heat units and has a tendency to lower the temperature of the woody mass, with constant cooling of the molten sulphur in immediate contact with the wood.

Effects of Treatment

The effect of the treatment on the wood is to indurate and strengthen it. Under compression parallel to the grain untreated pine withstood a maximum load of 3,500 lb. per sq.in., whereas pine treated with sulphur required 5,800 lb. per sq.in. to bring about failure. The treated wood is also much more resistant to impact and is several times harder than the untreated. If untreated hemlock is taken at 100, a sulphur-treated piece has a hardness under test of 300 to 350.

Sulphur being an insoluble solid at ordinary temperatures, the effect of the treatment is different from that brought about by the use of any other impregnant. Creosote does not change its form after entering the wood, nor do the various waxes such as Montan wax, or the metallic salts similarly employed. If such salts enter the wood in the form of a solution, the reverse is obviously true. On the other hand, the sulphur treatment injects an elemental fluid into the wood which becomes a crystalline solid and this change is so rapid that the surface pores are almost immediately closed through solidification of the sulphur and the "kick-back" such as occurs with other materials, is prevented. For example, when creosote oil is forced into wood under pressure, and this pressure is removed, a portion of the oil exudes from the wood because there is nothing to counteract the internal pressure. The rapid solidification of the sulphur on the surface and particularly at the ends of the treated wood, immediately seals the pores and prevents the loss of the molten sulphur contained within the woody structure.

Although not in itself toxic, sulphur should act as a preservative of the wood because it excludes and prevents the entry and action of many destructive agencies. In order to bring about wood rot, the presence of heat, moisture and oxygen are necessary and the sulphur excludes at least two of these factors. In other words, it preserves the wood physically rather than by chemical means and isolates it from the action of wood rot fungi. Since the treatment makes wood very much harder and more durable, it serves to protect it from mechanical abrasion and destruction.

In short, the process converts a soft and possibly useless wood into a very dense and durable hardwood. Certain species may be durable and resistant to wood rot, but are too weak mechanically for many purposes. An example of this is California redwood. Other species may be mechanically strong, but are subject to rapid decay and by impregnating with sulphur this might be inhibited.

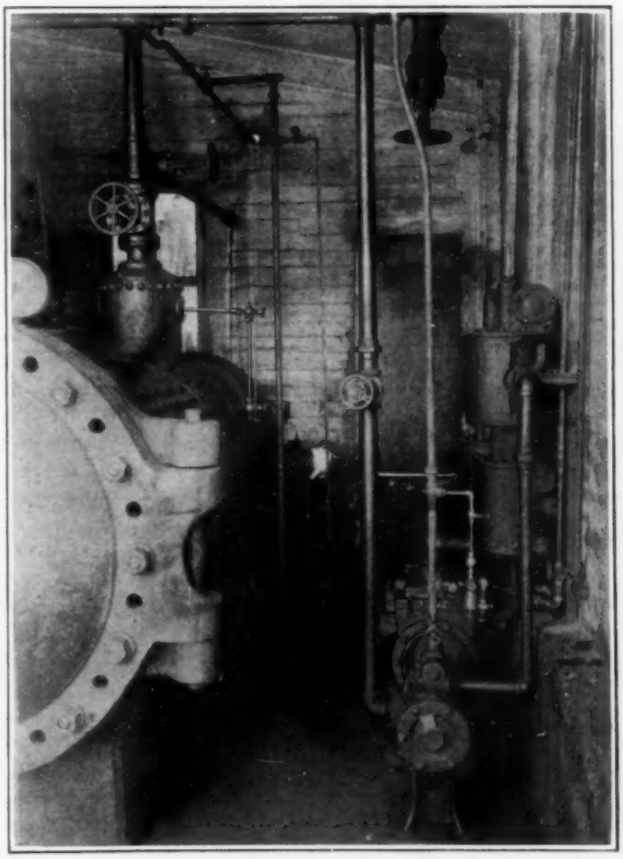
Sulphur also imparts many other desirable qualities to wood such as acid resistance, high dielectric strength and a "case hardened" surface which is subject to a high finish and polish.

There are many suggested applications for sulphur indurated wood in the arts and industry. It might be useful in the manufacture of bowling balls, tool handles, agricultural implement parts, automobile and other wheel spokes, paving and flooring block, railway ties, posts, poles and standards, telegraph cross arms, insulator cobs, pins and dowels, cooperage, box shooks, silo staves and for the construction of acid and other tanks for corrosive chemicals.

In the case of acid-resistant tanks, it may be desirable to impregnate the wood to refusal either by open-tank treatment or with vacuum and pressure, because it is essential to bring about maximum chemical resistance. Flooring block, however, should as a rule be only treated on the immediate surfaces and this may be accomplished by controlling the time of immersion. For example, California redwood is extensively used as a flooring material in the form of blocks, which are set in an asphaltic mastic, or other cementing medium. These blocks are very desirable for flooring since they are not subject to rot and are attractive in appearance. Their principal defect, however, is their softness and their lack of ability to withstand wear and abrasion. California redwood floor blocks may be case-hardened or indurated for an appropriate depth on all sides and faces say for one-quarter of an inch, and in this way materially hardened without a marked increase in weight.

As is well known, California redwood will last almost indefinitely in the ground but it cannot be used for railroad ties under heavy traffic on account of the rails cutting into and destroying the tie long before it has deteriorated in any way. By treating the ends or the entire tie with sulphur this tendency to rail cutting might be largely obviated.

The treatment of railway ties is, of course, not limited to redwood, but may be used on other species where it is desired to indurate and make more durable,



Pump, Gages and Pipe Connections for Sulphur Impregnation
Railroad ties treated for about 4 hrs. will absorb 5 to 30 lb. of sulphur per cu.ft., which will increase their physical and chemical durability

both physically and chemically. These sulphur treated ties should hold spikes much better than the untreated, and the process may be carried out in the usual creosoting cylinders now employed for injecting creosote oil into ties.

As far as appearance is concerned, the treatment has many advantages over creosote or any other medium which might be similarly employed. Sulphur changes the natural color of the wood but little, and since it acts as a filler, the surface may be given any of the usual finishes and also painted, shellacked, varnished or lacquered. It is also possible to add sulphur soluble dyes and thus inject permanent coloring matter.

The data presented in Table I on the treatment of railway ties were developed through co-operative work by the Texas Gulf Sulphur Co. and the Atchison, Topeka and Santa Fé Railway, under the direction of R. S. Belcher, manager of the Santa Fé treating plants. The treatments were carried out in one of the Santa Fé's experimental treating cylinders at Somerville, Texas, which is shown in the accompanying illustrations.

Table I—Results of Treating Railway Ties with Sulphur

Run No. 1—Hewn Pine Ties

Method of Treatment

Introducing	1 hr. 0 min.
100 pounds pressure up in	15 min.
100 pounds pressure held	2 hr. 0 min.
Forcing back	15 min.
Total time	3 hr. 30 min.

Temperature—260 deg. F.

Number	Cu.Ft.	Wt. In	Wt. Out	Gain per Tie	Gain per Cu.Ft.
		In Pounds			
1	3.50	135	228	93	26.57
2	3.31	123	235	112	33.84
3	3.61	133	225	92	25.48
4	3.11	127	200	73	23.47
5	3.31	128	233	105	31.72
6	3.31	112	249	137	41.39
7	3.11	122	217	95	30.55
8	3.61	129	209	80	22.16
9	3.31	130	195	65	19.64
10	3.61	127	207	80	22.16
11	3.31	134	230	96	29.00
12	3.50	117	249	132	37.71
13	3.31	138	181	43	12.99
14	3.11	103	208	105	33.76
15	3.50	107	148	35	10.00
Average gain in pounds per cubic foot					26.70

Run No. 2—Hewn Pine Ties, Sawn Pine Ties and 7 ft. Pine Posts

Method of Treatment

Introducing	1 hr. 0 min.
100 pounds pressure up in	15 min.
100 pounds pressure held	1 hr. 45 min.
Forcing back	15 min.
Total time	3 hr. 15 min.

Temperature—265 deg. F.

Hewn Pine Ties

Number	Cu.Ft.	Wt. In	Wt. Out	Gain per Tie	Gain per Cu.Ft.
		In Pounds			
16	3.61	138	243	105	29.09
17	3.50	150	242	92	26.29
18	3.31	121	219	98	29.61
19	3.31	122	220	98	29.61
20	3.61	136	216	80	22.16
Average gain in pounds per cubic foot					27.35

Sawn Pine Ties

Number	Cu.Ft.	Wt. In	Wt. Out	Gain per Tie	Gain per Cu.Ft.
		In Pounds			
1	3.11	122	161	39	12.54
2	3.11	102	147	45	14.47
3	3.11	130	175	45	14.47
4	3.11	111	179	68	21.86
5	3.11	113	175	62	19.94
6	3.11	108	140	32	10.29
7	3.11	125	164	39	12.54
8	3.11	113	149	36	11.58
9	3.11	125	205	80	25.72
10	3.11	118	188	70	22.51
Average gain in pounds per cubic foot					16.59

7-Ft. Pine Posts

Number	Wt. In.	Wt. Out	Gain	Number	Wt. In	Wt. Out	Gain
	In Pounds				*In Pounds*		
1	20	25	5	6	23	33	10
2	19	30	11	7	19	45	26
3	22	30	8	8	19	33	14
4	15	23	8	9	21	23	2
5	30	33	3	10	20	24	4
Average gain in pounds per post							9.1

Run No. 3—Sawn Red Gum Ties and 7-ft. Pine Posts

Method of Treatment

Introducing	1 hr. 0 min.
100 pounds pressure up in	15 min.
100 pounds pressure held	2 hr. 0 min.
Forcing back	15 min.
Total time	3 hr. 30min.

Temperature—265 deg. F.

Sawn Red Gum Ties

Number	Cu.Ft.	Wt. In	Wt. Out	Gain per Tie	Gain per Cu.Ft.
		In Pounds			
1	3.11	137	169	32	10.29
2	3.11	179	192	13	4.18
3	3.11	181	192	11	3.54
4	3.11	148	183	37	11.90
5	3.11	169	199	30	9.64
6	3.11	156	166	10	3.22
7	3.11	166	179	13	4.18
8	3.11	131	145	14	4.50
9	3.11	167	180	13	4.18
10	3.11	135	155	20	6.43
Average gain in pounds per cubic foot					6.21

7-Ft. Pine Posts

Number	Wt. In	Wt. Out	Gain	Number	Wt. In	Wt. Out	Gain
	In Pounds				*In Pounds*		
11	29	59	30	20	19	38	19
12	17	41	24	21	49	66	17
13	24	51	27	22	22	45	23
14	32	60	28	23	26	42	16
15	23	44	21	24	23	32	9
16	28	58	30	25	36	57	19
17	32	65	33	26	30	46	16
18	23	58	35	27	22	37	15
19	25	51	26				
Average gain in pounds per post							22.82

Lime in the Industrial Field

In discussing new opportunities for the use of lime in the industrial field, L. B. Burt, manager of the industrial department of the National Lime Association, pointed out before the recent convention of the association that lime is more economical than any other material possessed of similar chemical properties. Opportunities, however, are only profitable when they are developed, and it was pointed out how advantage might be taken of many new fields, and how better use might be made of some of the existing opportunities. Industrial processes are developing at an increasing rate and it is only by keeping abreast with these developments that lime will continue to be the leading base in chemical practice.

The use of lime has enjoyed a substantial increase in water softening and purification practices, and the immediate future looks even better than the past. Municipal water softening has trebled in the past 3 years and there is every reason to believe that the rate of increase will continue to be accelerated for some years to come.

In the treatment of trade wastes, lime is destined to function very largely as a neutralizing and precipitating agent, in some cases assisting in the production of commercially valuable byproducts. Progress is reported in the treatment of coal mining, creamery, tannery and steel mill wastes. The activity of all state boards of health is directed toward an early solution of the trade-waste problem and the National Lime Association through its research laboratories in Washington will be glad to co-operate in such work. A very important development along that general line is reported from the petroleum industry where stream pollution by wastes carrying salt water have for years been a serious matter. This development, in which lime performs an important function, solves the pollution problem and converts the waste into useful products.

The increasing use being made of technical information by lime manufacturers and users is a favorable index of increased appreciation. The 50 per cent increase during the past year in the number of lime plants employing chemical supervision indicates the increasing desire to improve products and service.

Corrosion Theories and Facts

A plea for more significant testing methods based on performance under conditions of actual service

By Peirce D. Schenck
President, The Duriron Co., Inc., Dayton, Ohio

SELECTION of the proper material for the construction of chemical engineering equipment has been complicated to an appalling degree by the well-meant, honest and sincere but usually misleading laboratory tests and consequent recommendations made by the various manufacturers of acid-resisting alloys. These recommendations are usually based on laboratory tests developed in individual laboratories according to the ideas of the technical men in the manufacturing organization. The apparatus used varies from a simple evaporating dish in which a sample is immersed for a given period in a solution at room temperature, to the widely varying forms of alternate immersion tests, agitated tests, aërated tests in which there has been no uniformity as to volume of air or amount of dissolved gases present, or to combinations of one or more of these methods. In such tests temperature, which is one of the most important factors in determining the rate of corrosion, often varies widely, and the method, if any, of maintaining a uniform concentration of the solution is rarely specified—at least in the published reports.

The confusion resulting from the publication of tests made under such widely varying conditions makes it an almost hopeless task for an engineer to make a decision based on the information contained in the literature of manufacturers or to depend on the statements in the average textbook which in turn have been largely compiled from work done by industrial laboratories.

An equally unfortunate and usually misleading factor is due to the well intentioned but obviously impossible attempt on the part of manufacturers to predict the life of apparatus constructed of a given alloy under service conditions which are not identical with the laboratory tests on which the prediction was based. The fact has not been generally considered that a corrosion test made under one condition will not in the remotest degree indicate the corrosion rate on a given metal under service conditions different in either temperature, concentration, degree of agitation or the amount of dissolved gases present.

As an example: Two of the leading manufacturers of acid-resisting alloys co-operated in making tests on identical samples of four different alloys. The composition, size and preparation of the samples were identical; the concentration and temperature of the solutions were identical. The solutions consisted of three different concentrations of sulphuric acid and three different concentrations of hydrochloric acid. The rate of corrosion determined varied from 50 to 1,000 per cent without the slightest indication of any uniformity in variation that would indicate the presence of a definite controlling factor. The only difference in the tests was in the rate of aëration and consequently the amount of dissolved oxygen present in the solutions. This difference in rate was undoubtedly responsible for the wide variation in results but had a vastly different effect on the corrosion of the various alloys.

The obvious conclusion is that the value of an alloy for a specific condition cannot be determined by laboratory tests unless the test is so designed as to duplicate service conditions. Nor can the relative value of a number of alloys be determined for any specific use unless they are all tested under exactly the same conditions.

Importance of Impurities

The question of the actual composition of solutions is an all-important one. The information given the laboratory is often merely to the effect that sulphuric, hydrochloric or other acids are to be used, of a given concentration and temperature in addition to the physical conditions to be encountered. But the all-important question of impurities or other elements present in solution is often omitted, or, if given, not carefully considered. Occasionally a very minute percentage of an element is present which in itself or in combination with the major part of the solution produces a corrosive condition entirely different from the specifications. Often these additions or impurities will act as catalysts and cause an extremely rapid and destructive corrosion, expensive alike to the user and manufacturer.

As a result of the varying methods employed and the unsystematic and incomplete manner of making and reporting such corrosion tests and the equally lamentable statements made by the salesmen and in the advertising copy of many alloy manufacturers, a lack of confidence in any statements regarding acid-resisting alloys on the market has limited the application of many of them which are immensely valuable when used with due appreciation of their characteristics. A thorough and scientific investigation would probably develop the fact that each of the alloys on the market has certain specific applications in which it is superior and that from a technical standpoint they are not actually competitive. If such information were available it would undoubtedly save thousands of dollars both to the manufacturers of the alloys and to the users.

In many instances the simplest and most satisfactory method of determining the proper metal to use is to place either a sample or a small piece of apparatus in an actually operating plant under service conditions. Where this is impractical it is usually possible to duplicate the service conditions in a laboratory sufficiently close to make at least a fairly accurate prediction. It would seem logical where a material is required for pump construction, valves and piping, to make a test with agitated solutions under the exact conditions of service which would give approximately the same rate of corrosion as would be encountered in the pumps and pipe lines; for spray nozzles, solutions agitated violently by air under highly aërated tests would be indicated; for many other conditions an alternate immersion test would give the best results; and it seems possible to duplicate most service conditions with comparatively inexpensive laboratory equipment.

Many unexpected and apparently unaccountable increases in the rate of corrosion are due to lack of consideration of electrolytic action between dissimilar metals. This is a matter, however, which must be determined by the designing engineer, as it is a factor which can be anticipated and to a large extent prevented.

Results of depreciation tests should be reported in terms of weight-loss per unit of exposed area, and not in percentages as is still occasionally done. The latter

method ignores the ratio of area to weight, and in the case of thin sheets indicates an excessive rate of corrosion when the actual depth of corrosion is slight.

Many improvements in the various methods of testing are possible and it is to be hoped that the various committees of the engineering societies now working on the problem will develop and recommend at the earliest moment specific and uniform methods of testing. No attempt should be made, however, to cover the problem by a single method. A number of standard methods will be necessary in order to make intelligent selections of a material and in addition many specific conditions will arise which will involve careful consideration and specially designed testing equipment.

Electrodeposition of Rubber Suggests Many Industrial Applications

Coating and protection of metal and wood surfaces made possible by development of new electrochemical process

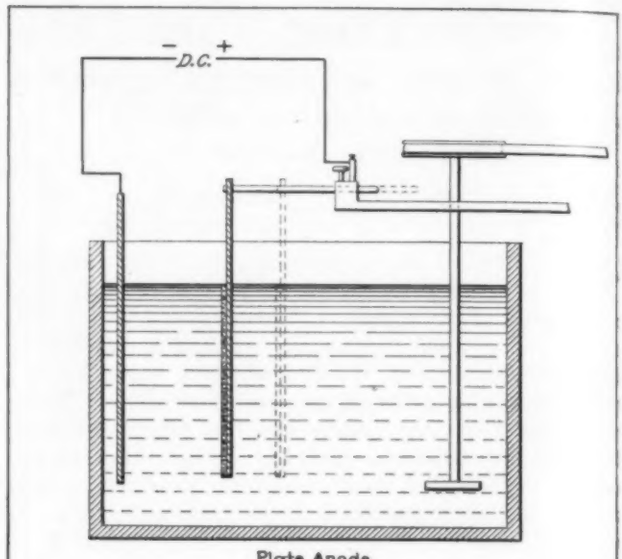
By Felix A. Elliott
Eastman Kodak Co., Rochester, N. Y.

ELECTRODEPOSITION of rubber has aroused considerable interest throughout the chemical engineering industries and many questions have been asked concerning possible industrial applications of this process. This article has been prepared, in part at least, to answer these questions. The process as developed in the research laboratories of the Eastman Kodak Co. is applicable to both artificial and natural rubber emulsions.

The particles of rubber in natural rubber latex, which has been ammoniated, and in artificial rubber dispersions in water are negatively charged. In an electric field they move toward the anode. This effect has been used previously to coagulate raw rubber electrically. By the present process it has been found possible to admix with latex or with rubber dispersion in water, sulphur, pigment and accelerator, and then to deposit this rubber compound electrically upon metals and other materials to form coherent homogeneous layers of a considerable range of thickness. These deposits can be vulcanized according to any desired cure and vulcanization factor.

To make this condensed description a little more concrete, let us take an example from one of the experiments conducted in the laboratory. A cell similar to that shown in the accompanying figure was used. The electrodes were 4 in. apart, the voltage was 110 and a current density of about 0.4 amp. per sq.in. was maintained. The rubber deposit was approximately 0.03 in. thick after one minute plating. The bath used is shown in Table I.

The rubber deposit from this bath had approximately the same percentage composition as the total solids in the bath, and the composition did not change materially until the bath was nearly exhausted. The smooth rubber deposit obtained was dried at 140 to 150 deg. F. and vulcanized 10 to 15 minutes in steam at 20 lb. pressure. This rubber was tough and strong, equal or superior to



Experimental Cell for Electrodeposition of Rubber

the ordinary mechanical stocks of similar composition. A direct current may be used either alone or with a superimposed alternating current. Although a nonconductor such as rubber tends to limit the thickness which can be built up of such platings, the limitations are not so serious as might be expected. In fact, some sheets have been produced as thick as 0.38 cm. or about .15 inch, measured after vulcanization. Considerably greater thicknesses have been produced by a modification of the procedure.

Table I—Composition of Bath Used in Electroplating with Rubber

	Concentration Grams per 100 cc.	Percentage of Total Solids
Rubber from latex	8.00	53.3
Sulphur	0.30	2.0
Zinc Oxide	1.50	10.0
Whiting	4.50	30.0
Carbon black	0.30	2.0
Paraffin wax	0.30	2.0
Tuads (accelerator)	0.03	0.2
Gum arabic	0.075	0.5
Total solids	15.00	100.0
Ammonia	0.16	

After washing and drying, the product is ready for vulcanization. Soft-rubber coatings are obtained with low sulphur mixes using D.P.G., Tuads, Zimate, or other suitable accelerators. For hard rubber a high sulphur mix is used with an organic or inorganic accelerator. The rubber can be cured in steam, water, air, or an inert gas, as desired.

A large number of specific methods of mixing and stabilizing rubber plating baths for various purposes have been developed. As an important example, methods of dealing with gassing at the electrode may be instanced (S. E. Sheppard and L. W. Eberlin, U. S. patent 1,580,795). In fact, in the working out of the process, many interesting and important developments in practical colloid chemistry have arisen. Almost every day some novel possibility could be envisaged and applied in this combined process of electrophoresis and electrolysis, for not only is electric transport of colloid material taking place, but also electrochemical decomposition of the constituents of the bath. Processes have been developed for removing gaseous products, for preparing metals for deposition of rubber, for depositing cellulosic and other organic bodies simultane-

ously or alternatively with rubber, for compounding and stabilizing various ingredients. While it is not possible to discuss these particular aspects, it may be said that these developments ensure a wide field of usefulness for the new process.

Wherever applicable the process of electrodeposition of rubber, offers a greater economic advantage over the process of milling and spreading mechanically, principally by reason of the reduction of power and labor. Mixing and compounding can be accomplished at greatly reduced cost by high speed mills operating on the liquid. Electrodeposition is again cheaper than mechanical spreading and forcing. Generally, also, electrodeposited rubber will have greater strength, other things being equal, than mechanically milled rubber, since it has not been degraded by friction. The general types of production possible by this method are:

1. Coating metal surfaces with rubber vulcanized either soft or hard, of variable thickness.
2. Coating and impregnating fabrics; the coatings may be of any desired thickness, and impregnation varied over a wide range.
3. Coating permeable non-conducting material other than fabrics.
4. Coating impermeable non-conductors after galvanoplastic treatment or metal spraying.
5. Preparing certain types of molded or dipped goods by depositing on metal forms and stripping.
6. Production of sheet rubber.

Although the character of the metal is of importance, rubber has been successfully electroplated on lead, zinc, tin, cadmium, antimony, certain alloys of these, and upon iron and steel under certain conditions. Copper and copper alloys are usually unsuitable. Because of the excellent "throwing power" of these rubber plating baths, the corners, edges and contours can be well and uniformly covered. Adequate stirring is, of course, important as well as certain other technical precautions.

In addition to plating on metal, the process can be used to deposit rubber on non-metallic supports. This may be done by impregnating the non-conductor, if porous, with electrolyte, thereby connecting it electrolytically with the anode. (cf. S. E. Sheppard and L. Eberlin, U. S. Patent, 1,476,373 and later patents). If it is not porous, the object may be made conducting by graphitizing or metallizing.

The production of certain types of molded goods, and of goods now produced by dipping is another promising field.

The specific applications of the foregoing general processes are so numerous that no attempt will be made to catalog them exhaustively. Among the more important, however, are the production of coated fabrics for automobiles; waterproofed textiles, paper and wood products; coated metal wire for insulating and protective purposes; coated metal apparatus such as rubber lined tanks, pipes, mills, screens, pump and valve parts and like small metal articles. In the rubber goods industries most interest attaches to possibilities for the continuous production of rubber sheets, of rubber slab stock for molded goods and the direct production of molded or dipped articles by electroplating, such as inner tubes for tires, rubber gloves, finger cots, etc.

It is of interest to survey the new process strictly from an economic point of view. By dealing with the raw latex which is shipped by tankers direct from the plantations, all uncertainty as to methods of coagulation is eliminated. Rubber latex as usually shipped has a solid rubber content of approximately 35 per cent. This means of course that there is an economic loss in transporting a large bulk of water. But a number of effective processes of concentration are being developed. Satisfactory latex of 60 per cent rubber content has already been shipped, and it is hardly too much to expect that higher concentrations will soon be possible. Even solid cheese-like masses which will homogeneously disperse in water are within the realm of possibility. Various processes of emulsifying coagulated rubber to form aqueous dispersions have been developed, and these will have an important rôle in utilizing waste and scrap in the new process.

The cost of mixing the fillers, sulphur and vulcanizing agents in the liquid state is much less than for solid compounding and the chances of uniformity are greater. Although the cost of current is a large factor, this is not necessarily so serious as to demand location in special districts where electricity is cheap. Even at 4 to 5 cents per kilowatt-hour it is believed that this process can be worked at an economic advantage over other methods of producing the same type of goods.

While there are a number of applications specified in the foregoing in which the electrical process would have to compete with established mechanical procedures, probably the most promising is in the novel use of rubber in the coating and protection of metals—a field of broad interest to the chemical engineer in industry.

This process is the result of research by S. E. Sheppard, L. W. Eberlin and C. L. Beal of the Eastman Kodak Research Laboratories and is broadly protected by the U. S. Patent 1,476,373 issued in 1923, and by a number of subsequent patents all of which are assigned to the Eastman Kodak Co.

Requirements for Absorbent Oil

Years of experience have convinced the natural gasoline manufacturer that certain physical and chemical characteristics of the absorbent oil should be observed in order that the most satisfactory recoveries from natural gas might be obtained for the quality of the finished natural gasoline required. Certain of these requirements were listed as follows by Arthur L. Davis, chief chemist of Empire Refineries, Inc., in a paper before the convention of the Association of Natural Gasoline Manufacturers:

Color.—Good, to guarantee no lowering of color of the finished natural gasoline due to contamination by small quantities of lower boiling fractions.

Distillation. — Initial boiling point well above maximum boiling point of natural gasoline.

Doctor.—Sweet, to guarantee no contamination of finished natural gasoline by the presence of small quantities of sour absorbent oil.

Emulsion.—Good, in order that emulsion troubles in absorption system cannot possibly originate with the oil.

Pour Point. — Low, so that satisfactory circulation and distribution of absorbing medium may be had under all operating temperatures encountered.

Saturation.—High, since maximum saturation obtainable from gas of any given natural gasoline content, with equal recovery, lowers operation costs.

Unsaturation.—Low, since products of high per cent unsaturated compounds do not seem to be the most suitable absorbents.

Vapor Pressure.—Low, in order that losses due to saturation of all natural gas treated with absorbent oil may be reduced to the minimum.

Viscosity.—Low, in order that maximum distribution may be secured.

Low Temperature Carbonization and Steam Generation

Direct connection of retorts to stokers or other boiler firing apparatus and firing of gas over fuel bed give high thermal efficiency

ON February 17 last, a comprehensive paper was read by David Brownlie before the Institution of Mining Engineers in which a complete resumé was given of the existing situation with reference to the application of low temperature carbonization to the firing of steam boilers. Although the thought is often expressed that the semi-coke produced from low temperature plants can be well used for firing boilers, it is the opinion of Mr. Brownlie that the most economical procedure is to make the carbonization retort a part of the boiler installation, so that the fuel as produced is fed directly to the grates of the boilers without loss of heat.

Such a procedure is not thought to be feasible in the case of the small boiler plant, particularly one with fire-tube boilers, because of the small throughput of each unit, but is recommended for application with water tube boilers of fair size, say, from 5,000 sq.ft. of heating surface up. Such a size of unit gives a sufficient throughput at each retort so that the low temperature process can be economically carried out. Because of variations in demand and other factors it is not thought practicable to connect two smaller boilers to one retort.

A particularly promising field for this type of installation is said to be boiler plants installed in connection with coal mining operations. At the coal mines there is always available a more than sufficient supply of low grade fuel to feed the boilers and, if this fuel is improved by subjecting it to the low temperature carbonization process, a far higher economy can be realized at the coal mine boiler plant. There are other promising fields for the installation of this combination process, in particular the central station electric generating plant, where the large size boilers and the consequent large amount of coal used daily would result in the production of a sufficient amount of by-product tar oil to render each plant a real factor in the tar market. It is also suggested that this low temperature carbonization method can be well tied up to other types of fuel use, such as producer gas generators and various types of furnaces used in the iron and steel industry, as well as kilns, glass furnaces, and various other heating operations.

From a theoretical point of view it is not good practice to fire a boiler with coal at say 60 deg. F., with 10 to 20 per cent of moisture, when the furnace temperature is from 2,000 to 2,500 deg. F., because all the water contained in the coal must be raised in temperature, evaporated and superheated and will then escape from the furnace carrying with it all the latent heat and superheat absorbed. Thus every pound of water carried as moisture in fuel takes about 1,250 B.t.u. in its evaporation and superheat, and each 1 per cent of moisture reduces the heat value of each pound of fuel by about 12½ B.t.u.

From the point of view of thermal efficiency, therefore, it would be best to dry all coals before they are burnt in a boiler furnace. This is not often done except in the firing of pulverized fuel, because the fact is often lost sight of that the reduced fuel consumption due to the elimination of this moisture from the furnace is very likely to balance or nearly balance the cost of this drying operation.

The application of low temperature carbonization to boiler firing operations is quite similar to the application of drying except that in addition to removing the steam or water from the coal the tar oils are recovered at the same time. Predrying in connection with stoker firing has been experimented with for many years and there are cases dating back as far as 1870, where drying chambers have been added to chain grate stokers and have given very good results. Also, for pulverized fuel burning, dryers have been constructed utilizing a portion of the hot waste flue gases for the purpose of predrying the coal before it enters the pulverizing mill. Such dryers have been incorporated in many of the commercially successful pulverized fuel firing systems now in use.

It is but a short step from the use of predrying equipment in connection with boiler firing to the use of low temperature carbonization equipment, and a step that does not involve the expenditure of much additional capital. In the general scheme of such application the coal before being fed to the stoker or to the pulverizing mill is led through a retort in which it is heated by some of the hot waste gases from the boiler or by superheated steam to a temperature of around 1,000 deg. F., for a sufficient length of time to expel about two-thirds of the volatile content and all of the moisture. The resulting semi-coke is either fed to the stoker for direct firing or is pulverized and then fired through pulverized fuel burners. The gas and volatile products are taken through a condenser where the tar is removed and the remaining gas is then led to gas burners and fired in the same boiler. In the system using a stoker for firing the semi-coke to the boiler the particular advantage is realized of firing the material while still red hot and thus saving heat that would otherwise be lost.

Systems in Use

Several systems of applying low temperature carbonization to boiler firing have been tried out and one of these is in rather extensive use at the present time with nine operating plants and several more building. This latter system is the process of the Julius Pintsch Co. in Germany. It consists in submitting the fuel to low temperature carbonization in a very short closed vertical retort or hopper operating on the mechanical continuous principle and attached over the front of the boiler, feeding directly to a traveling grate type of mechanical stoker. The retort replaces the ordinary coal hopper and is heated by hot gases taken from over the fires at about the middle point of travel. Crushed coal is supplied by means of a traveling conveyor and the retort is kept completely filled with the charge through a gas tight feeding device. After carbonization the fuel is continuously withdrawn from the bottom of the retort, traveling downward by gravity, and passes in a red hot condition onto the traveling grate stoker, the speed of which regulates the throughput of the retort.

The flue gases used for heating are at temperatures

Abstract from a paper read by David Brownlie before the Midland Counties Section, Institution of Mining Engineers, at Nottingham, England, Feb. 17, 1926.

of from 1,000 to 1,250 deg. F., and in volume of 35,000 to 45,000 cu.ft. per ton carbonized, approximately 10 to 20 per cent of the total gases given off in the furnace. These gases pass up through the descending charge and with the by-products of the coal are taken out of the top of the retort by means of a suction fan which delivers them to the condenser where the tar oils are removed. Most of the actual carbonization is carried out at temperatures of 900 to 1,000 deg. F., giving a true low temperature tar. In the condensing plant no attempt is made to remove anything except the tar oils because the amount of ammonia or light oil that might be obtained from scrubbing the relatively large amount of gas is insufficient to warrant recovery.

The approximate average yield from one ton of raw coal treated in this way (figures refer to an average non-caking German steam coal) are 40,000 cu.ft. of low grade gas of 110 B.t.u. per cu.ft. heat content, 16 to 20 gal. of tar oils and 1,568 lb. or 70 per cent of stoker fuel.

The first plant employing the Pintsch process was erected at the municipal lighting station of Lichtenberg near Berlin, Germany, where two Steinmueller water tube boilers were fitted with retorts in 1919. This plant was run for experimental purposes for six months with a fuel mostly consisting of brown coal briquets with a net calorific value of 8,800 B.t.u. per lb., 5 per cent ash, 13 to 20 per cent moisture and a throughput of 70 to 90 tons per 24 hours. The by-product yield consisted of about 12½ gal. of low temperature tar per ton of briquets; that is 5½ per cent. The net thermal efficiency of the installation, taking into account the heating value of the tar recovered, was around 82½ per cent, which is considered good as the boilers were of an old-fashioned type lacking many of the modern appliances which would have raised the efficiency. The residual mixed gas had a heating value from 110 to 164 B.t.u. per cu.ft. and left the retort at a temperature of 212 deg. F.

At the present time this plant has been closed down, but nine others have been built and are now in operation in Germany and Norway, including two at coal mines in Upper Silesia. One of these coal mine plants, that at Prinzengrube, uses for fuel waste coal from the mine and prior to the installation of the low temperature carbonization unit the efficiency of steam generation was only 50 per cent. The use of the retort has resulted in a much greater thermal efficiency, so that slightly less raw fuel is now used for the same steam output, which makes the entire tar output obtainable without extra coal consumption.

Much work has been carried on along the lines of applying low temperature carbonization to boiler firing by Messrs. Merz & McLellan of Newcastle-on-Tyne, England. This firm has been carrying on their experiments for some eight years, but have not yet reached the point where they desire to make the results of their investigations public. It is known, however, that the main difference between the system that they employ and that described above is that heating is accomplished with superheated steam only and not with flue gases. In the Netherlands the firm of Pluto Stoker Co., Ltd. has also patented a process for carbonizing coal in direct conjunction with a water tube boiler by means of superheated steam as an internal heating agent. No general information is available as to the results obtained with this process.

Much work along these same lines has been carried out by C. B. Wisner of the Carbocite Co., Canton, Ohio. The process that he uses is somewhat different from those generally employed, consisting of first preheating the coal by means of a current of heated air at a temperature which never exceeds 600 deg. F. and is always so regulated as to be below the temperature at which volatile is released from the raw material. The result of this preheating is to drive out the moisture from the coal and to cause it to absorb oxygen without giving up any of its volatile matter or changing its non-viscous condition. After this preheating has been carried out for a period of about 45 minutes the coal is immediately introduced into another retort in which the actual carbonization is carried out. Both of these retorts are of the horizontal rotary type, that used in the experiment being 40 ft. long and 4 ft. in diameter. The carbonization carried out in the second of these is conducted at a temperature of not over 900 deg. F. and lasts from 45 to 70 minutes. Thus the whole treatment of the coal does not exceed 2 hours for the two stages and the coal is at no time subjected to a temperature higher than 900 deg. F., which insures true low temperature carbonization. Yields from this process are said to be as follows: Gas, 2,640 cu.ft. at 880 B.t.u. per cu.ft.; light oil, scrubbed from the gas, 1 gal.; tar oil, 30 gal.; ammonia liquor, 55 lb.; and semi-coke, 1,590 lb., or 74½ per cent. This process does not seem to have been tried out commercially on a large scale so that few actual figures of thermal efficiency or utility are available.

Another interesting American experiment is that being conducted at the Lakeside Station of the Milwaukee central station company where a low temperature carbonization process is being installed in connection with the pulverized fuel firing of boilers. This process, known as the McEwen-Runge process, consists in carbonizing the pulverized fuel by a counter-current of hot gases and then feeding the carbonized product to the pulverized fuel burners, the hot gases taking away the volatile matter which may be condensed out from them later. A vertical cylindrical continuous retort is used, the pulverized fuel being passed down this in a continuous stream with the heated gases passing up from bottom to top.

This process can be operated in a single stage but the double stage is said to be preferred, that is, two retorts are used, one above the other in series, which for a throughput up of 200 tons per day, would each be about 30 ft. high. In the first or upper preheating retort the average temperature is about 600 deg. F., with a large proportion of air in the heating gases and the duration of travel of each particle is about 35 seconds. In the second retort the temperature is approximately 1,000 deg. F. with heating gases entering at the bottom at 1,500 deg. F., and leaving at the top at about 700 deg. The time of passage of the coal particles is about 35 seconds in this retort also. Yields from this process are said to be as follows: Gas, 7,000 to 8,000 cu.ft. per ton at about 400 B.t.u. per cu.ft.; light oil, 2 gal.; tar oil, 18 to 20 gal.; and low temperature fuel, 1,616 lb., or 72 per cent.

The commercial installation of this system at Milwaukee has not yet been completed, so it is not known at the present time whether the various difficulties that are sure to be encountered in any experimental installation have as yet been overcome.

Interchangeability of Oils and Fats in the Soap Industry

Tariff Commission reports on the economic and technical factors that determine suitability for use in the largest of the industrial outlets for inedible oils

Editor's Note: But little quantitative information has ever been available on the industrial consumption of oils and fats and particularly on the competitive relation that exists among the different products in their ultimate uses. The soap industry, because of its size and varied production, offers the broadest possibilities for this interchange of raw materials. It is of interest, therefore, to study the consumption statistics in this industry over a considerable period in order to evaluate the factors that determine suitability. Such a study has recently been completed by the United States Tariff Commission in its investigation of vegetable oils under the provisions of the flexible tariff. The following article, abstracted from the commission's preliminary statement of information, is typical of the economic study that has been made in each of the principal oil-consuming industries.

ANY OIL or fat may be converted into soap, but the kind of soap produced will vary greatly because of the widely different physical and chemical characteristics of the various oils and fats used. Each kind or grade of soap is made from an oil or combination of oils that will yield a product of the desired properties. When there are considered the many types of toilet soaps and the large variety of soaps that are used in everyday life, as, for example, soap chips, soap powders, laundry, scouring, shaving, shampoo, medicated, liquid, mechanic's, textile, and automobile soaps, it will be seen what a wide difference exists in the soaps obtained by the use of various oils and fats and other ingredients and by different methods of manufacture.

Factors Determining Interchangeability

Interchangeability in the soap industry does not mean complete substitution of one oil for another. Although this may occur, interchangeability usually involves changes in the relative proportions of the constituent oils and fats, and also substitution of other materials for a portion of one or more of the constituents, as dictated by prevailing prices.

One of the most important factors in buying oils and fats for soap making is the titer of the material, which indicates the hardness of the soap that can be made from it. Manufacturers endeavor to have each brand of soap of a uniform consistency. In making hard soaps, materials of low titer, such as soya-bean, cottonseed, olive, corn, or whale oils, cannot be used exclusively. If they are used they must be mixed with a material of high titer, such as tallow, palm oil, or coconut oil.

The fatty-acid content is important from the soap maker's point of view, inasmuch as the higher the fatty acid, the smaller is the recovery of glycerine—a valuable byproduct. In general, materials of high fatty-acid content do not make satisfactory stock for soaps (including most toilet soaps) which are made by direct treatment of oils and fats in the soap kettle with caustic soda. The free fatty-acid content is of less importance, except for the recovery of glycerine, in oils and fats used for laundry and industrial soaps, which are largely made from fatty acids after being separated from the oil or fat.

The color of an oil or fat is not usually so important in making soaps as it is in the manufacture of edible products. However, white soaps, soap chips, and soap powders must be made from materials which will yield a product of good permanent color. The oils and fats most suitable for white soap are coconut oil, tallow, and white greases. These are not fully interchangeable with each other because of the different properties which they impart to the finished soap. Some soaps are made from oils which give a characteristic color to the product, such as the green of olive-oil foots, and the orange shade of palm oil. Such oils cannot be used in white soaps in amounts which will affect the color.

Yellow laundry soaps are made from lower grade materials the color of which often cannot be removed. Such materials include low-grade tallows, garbage and tankage grease, yellow and brown greases, vegetable-oil foots, fish oils, and offgrade cottonseed oil. Rosin is commonly used in laundry soaps and imparts a yellow color to the soap. White laundry soaps have replaced the yellow to a considerable extent; they are made from better grades of oils and fats, such as coconut oil, tallow, and white greases. The soap used in scouring powders is usually made from vegetable-oil foots, tallows, and greases.

Soaps possessing special characteristics are made from certain individual oils. Pure castile soap should be made from olive oil only. Much of the soap sold in the United States as castile soap, however, is made from oils or fats other than olive oil. Shaving, marine, and hard-water soaps usually contain a large proportion of coconut oil because of the excellent lathering qualities of soap made from it. Certain transparent soaps are made from castor oil. Linseed oil is the basis of some liquid soaps.

Classified by Technical Characteristics

Some of the principal oils and fats used in the manufacture of soap may be divided into three rather broad classes. The grouping shows the titer and the iodine number of each oil or fat. The titer indicates the hardness of the soap resulting from the oil and the iodine number of amount of hydrogen that the oil will combine with when hardened.

In general, it may be said that in the manufacture of soap the substitution of one oil for another is made within the limits of each group. It is, of course, pos-

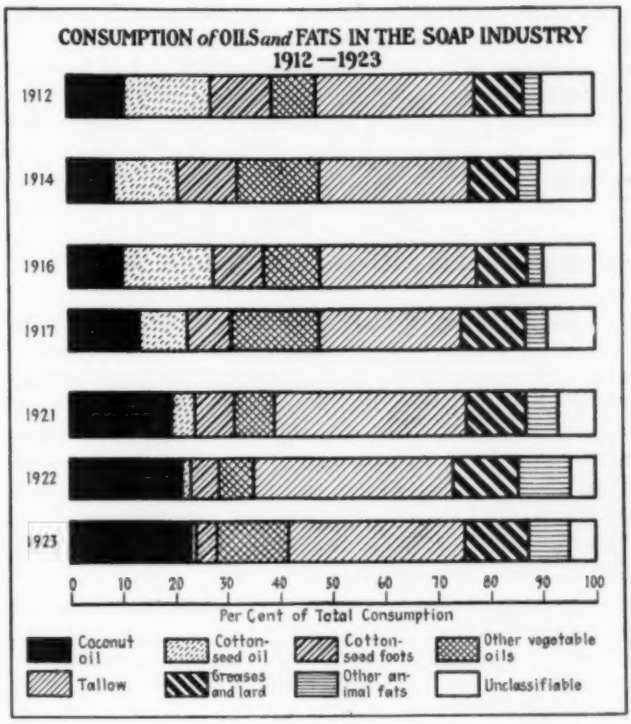
sible to make an oil in Groups II or III comparable with tallow and palm oil in Group I by the process of hydrogenation or hardening. Unless a soap company is also engaged in the manufacture of lard substitutes, which require the hardening of vegetable oils, it is not ordinarily equipped to harden oils for exclusive use in the manufacture of soap. Such companies therefore depend largely upon oils and fats that produce hard soaps, such as tallow and palm oil, since they prefer not to buy hardened oils from competing companies.

Table I.—Titer and Iodine Number of Typical Soap Oils

	Titer	Iodine Number
Group I:		
Tallow	38–48	35–41
Palm oil	36–45	53.3
Group II:		
Coconut oil	22.5–25	8.4– 9.3
Palm kernel oil	20.5–25.5	12
Group III:		
Cottonseed oil and foots	32–35	111–115
Soya-bean	21.2	138–142
Peanut oil	29.2	95–104
Corn oil	19	119.5
Olive oil foots	17–26	86–90

Palm oil and tallow are not so closely related that one can completely replace the other, but palm oil may in part replace tallow in soap.

In Group II, coconut and palm-kernel oils are practically equivalent, and a difference in price of one-eighth to one-quarter cent per pound may cause a shift from one to the other oil. The oils and fats in Group III make softer soaps than those in Groups I and II. These oils are generally used to reduce the titer or hardness of soap made from tallow and palm oil. In this group cottonseed, peanut, and corn oils, except foots and off grades, are ordinarily too high priced to be used for soap. Corn oil when used in the manufacture of soap oxidizes and thereby tends to darken the finished product; it also develops an unpleasant odor in the soap. Cottonseed oil not only is too expensive for the cheaper grades of soap, but when used in the finer grades of toilet soaps causes them to deteriorate.



Soap makers who specialize in trade-marked brands of soap which are widely advertised are more conservative in shifting from one oil to another. They will not risk the loss in sales which might result from modification of their soap formulas to an extent noticeable by consumers of their products. Olive-oil foots and palm oil produce colored soaps. Obviously such oils cannot be used in white soaps in appreciable amounts.

Table II.—Consumption of Oils and Fats by the Soap Industry in the United States, 1912, 1914, 1916, 1917, 1919, and 1921-1923

(In thousands of pounds)

Consumption of—	1912	1914	1916	1917	1919	1921[1]	1922[1]	1923[1]
Vegetable oils:								
Coconut	78,816	77,959	111,084	168,602	182,613	194,417	237,702	267,982
Corn	9,822	11,368	12,821	15,997	2,405	2,405	4,941	5,617
Cottonseed	132,312	119,254	194,916	126,390	56,130	47,935	19,759	10,824
Olive-oil foots	5,457	7,298	9,411	10,500	3,964	15,842	20,688	27,324
Olive oil, inedible	690	748	1,184	1,731	935	767	1,047	1,317
Palm	7,546	[2]71,896	14,938	27,345	17,268	24,386	30,389	102,323
Palm kernel	20,579	31,376	5,804	4,762	4,551	593	685	3,287
Peanut	31	76	1,181	15,126	3,055	10,983	6,711	6,905
Soya bean	1,182	4,499	57,373	124,058	58,401	10,756	2,307	3,266
Cottonseed foots	89,127	108,141	112,178	115,942	108,389	76,018	61,966	52,676
Miscellaneous	20,142	17,831	21,604	25,694	20,328	11,807	9,952	10,477
Total	365,704	450,446	542,594	636,147	457,769	395,909	396,147	491,998
Animal fats and oils:								
Bone grease	17,526	16,632	19,535	37,032	[3]	839	2,107	1,308
Garbage grease	12,619	13,627	28,719	63,118	[3]	19,104	22,010	15,493
Lard	8,469	10,484	8,294	7,481	[3]	[4]	[4]	[4]
Recovered grease	2,858	10,627	8,531	12,680	[3]	[4]	[4]	[4]
Tankage grease	28,566	31,822	35,769	38,303	[3]	247	1,427	173
Tallow	238,685	270,713	338,931	362,297	[3]	373,223	429,966	401,926
White grease	[4]	[4]	[4]	[4]	[3]	31,489	36,902	42,669
Yellow grease	[4]	[4]	[4]	[4]	[3]	32,009	36,872	39,352
Brown grease	[4]	[4]	[4]	[4]	[3]	30,461	42,667	41,170
Red oil	8,723	10,275	10,230	12,812	24,205	13,149	10,431	12,233
Herring and sardine oil	56	10,339	2,705	4,104	[3]	32,592	29,689	31,941
Menhaden	116	882	330	2,279	[3]			
Whale oil	9,927	4,023	8,126	5,732	[3]	5,021	60,816	41,328
Miscellaneous	7,272	13,202	18,860	30,919	406,412	12,241	9,217	11,857
Total	334,817	392,826	480,030	576,757	430,617	550,375	682,104	639,450
Unclassifiable:								
Fatty acids	29,500	35,842	61,915	74,515	30,653	48,935	32,678	32,575
Acidulated soap stock	20,135	32,075	20,473	25,086		22,104	21,130	24,753
Miscellaneous soap stock	25,000	25,000	25,000	25,000	.....	.....	.....	.....
Total	74,635	92,917	107,388	124,601	30,653	71,039	53,808	57,328
Grand total	775,156	936,189	1,129,812	1,337,505	919,039	1,017,323	1,132,059	1,188,776

[1] Estimated from data submitted to Tariff Commission.
[2] Bulletin 769, U. S. Department of Agriculture, Supplement, p. 6, reported 71,896,000 pounds of palm oil consumed in soap in 1914. This figure is apparently an error, since it exceeds imports of palm oil in either 1913, 1914, or 1915 by about 20,000,000 pounds.
[3] Included in miscellaneous animal fats and oils.
[4] Included in other specified animal fats and oils.

Sources: 1913–1917, inclusive, Supplement to Bulletin 769, U. S. Department of Agriculture; 1919, Bureau of the Census; 1921–1923, based on data obtained by the U. S. Tariff Commission from 74 firms, producing 90 per cent of the total soap production.

So numerous are the factors entering into the making of a soap that it is not possible to state definitely the exact degree of interchangeability which exists between the various oils and fats. The extent to which interchangeability or substitution is possible depends not only on the soap maker but on the kind of soap produced. Therefore, only the above generalizations can be made, and emphasis laid on the more important factors, such as titer, color, odor, fatty acid, brands and trade-marks, and price, which affect interchangeability.

Table II shows the consumption of oils and fats by the domestic soap industry from 1912 to 1923, inclusive, except the years 1913, 1915, 1918, and 1920. The estimated consumption for 1921 to 1924, inclusive, is based on returns to the Tariff Commission from 74 companies producing about 90 per cent of the total soap production. The accompanying chart, based on the figures of Table II, indicates the relative percentages of the different oils and fats used by the soap industry in seven typical years since 1912.

Table III—Relative Consumption of Oils and Fats by the Soap Industry in the United States, 1912, 1914, 1918, 1916, and 1921-23
(Percentage of total oils and fats consumed)

Consumption of—	1912	1914	1916	1917	1921	1922	1923
Vegetable oils:							
Coconut	10.2	8.3	9.9	12.6	19.1	21.0	22.5
Corn	1.3	1.2	1.1	1.0	.2	.4	.5
Cottonseed	17.1	12.3	17.3	9.5	4.7	1.7	.9
Olive-oil foots	.7	.8	.8	.8	1.6	1.8	2.3
Palm	1.0	[1]7.7	1.3	2.0	2.4	2.7	8.6
Palm-kernel	2.6	3.3	.5	.4	[2]	[2]	.3
Peanut	[2]	[2]	[2]	1.1	1.1	.6	.6
Soya-bean	[2]	.5	5.1	9.3	1.1	.2	.3
Cottonseed foots	11.5	11.5	9.9	8.7	7.5	5.5	4.4
Miscellaneous	2.9	2.5	2.1	1.9	1.2	1.1	1.0
Total	47.2	48.1	48.0	47.3	38.9	35.0	41.4
Animal oils and fats:							
Greases and lard	9.0	8.9	8.9	11.9	11.2	12.5	11.8
Tallow	30.8	28.9	30.0	27.1	36.5	38.0	33.8
Red oil	1.1	1.1	.9	1.0	1.3	.9	1.0
Fish oils	[2]	1.2	.3	.5	3.2	2.6	2.7
Whale oil	1.2	.4	.7	.4	.5	5.4	3.5
Miscellaneous	1.1	1.5	1.7	2.5	1.4	.8	1.0
Total	43.2	42.0	42.5	43.4	54.1	60.2	53.8
Unclassifiable: Total	9.6	9.9	9.5	9.3	7.0	4.8	4.8

[1] See note 2, Table II. [2] Less than one-tenth of 1 per cent.

In 1923, 56 per cent of all the oils and fats used by the reporting companies in the soap industry was made up of tallow and coconut oil, 34 and 22 per cent, respectively, of all oils and fats. If other animal greases are added the total would represent more than two-thirds of the oils consumed in the manufacture of soap. Among the other oils and fats consumed by the soap industry are palm oil (8.6 per cent of all oils and fats), fish oils, including whale oil (6.2 per cent), and cottonseed foots (4.4 per cent).

Coconut oil is now the most important vegetable oil used in soap manufacture, making up 23 per cent of the total of oleaginous materials. The use of this oil has steadily increased and is now more than twice as great, in relation to all oils, as in 1912 and 1914, and the actual quantity consumed is more than three times as much. The import duty of 2 cents a pound on coconut oil does not apply to shipments from the Philippines, which are about 96 per cent of the total quantity entering the United States. Nor is there a duty on imports of copra, whatever the origin. More than 99 per cent of the coconut oil used by soap manufacturers since 1921, including the oil produced in this country from imported copra, was exempt from import duty.

Palm oil, which is not dutiable, was unimportant in 1912, supplying less than 1 per cent of the total consumption of oils and fats used in soap factories. In no year between 1912 and 1917, inclusive, did the consumption of palm oil exceed 2 per cent of the total. In 1921 and 1922 palm oil supplied about 2.5 per cent of the total consumption, and in 1923 about 9 per cent (102,323,000 pounds). The consumption of inedible olive oil, including olive-oil foots—also nondutiable—has also shown a significant increase, although still a small part of the total. In 1923, the consumption was 28,641,000 pounds, or between four and five times the pre-war figure, but represented only 2.3 per cents of all oils and fats. Palm-kernel oil, which is a substitute for coconut oil, has declined greatly, not only in actual quantity but in relation to all oils consumed. The consumption in 1923 was only one-tenth of that in 1912 and 1914 and was only three-tenth of 1 per cent of all oils used. Although a desirable oil and exempt from duty, British control of the trade in and crushing of palm kernels, prevents its extensive use in the United States. Palm-kernel oil is one of the most important oils used for soap making in England.

The increase in the use of soya-bean oil by the soap industry from 1,000,000 pounds in 1912 to 124,000,000 pounds in 1917, and the subsequent decline to less than 3,500,000 pounds in 1923, is one of the striking changes that have occurred in the consumption of oils by the soap industry. But in relation to the total consumption of oils and fats in soap, soya-bean oil has never been of major importance. At the peak of consumption, in 1917, under abnormal conditions of demand for all oils and fats, it supplied only 9 per cent of the total. (See Tables II and III.)

Cottonseed oil in pre-war days was an important soap material, supplying (together with the foots) between 200 and 300 million pounds annually, or 25 and 30 per cent of the total oils and fats consumed in the industry. After 1916 there was a steady decline in the utilization of cottonseed oil, until in 1923 it constituted less than 1 per cent of all oils and fats used in soap. The consumption of cottonseed oil and foots by the soap industry in 1923 was 63.5 million pounds, or less than 6 per cent of the total consumption of all oils and fats. Table IV gives comparative figures for cottonseed oil and foots and soya-bean oil used in the manufacture of soap.

Table IV—Comparison of Consumption of Cottonseed Oils, Cottonseed Foots, and Soya-Bean Oil in Soaps, 1912-1923

	Cottonseed Oil		Cottonseed Foots		Soya-bean Oil	
Year	1,000 Pounds	Per Cent of Total Oils Used	1,000 Pounds	Per Cent of Total Oils Used	1,000 Pounds	Per Cent of Total Oils Used
1912	132,312	17.1	89,127	11.5	1,182	0.2
1914	119,254	12.7	108,141	11.6	4,499	.5
1916	194,916	17.3	112,178	9.9	57,373	5.1
1917	126,390	9.5	115,942	8.7	124,058	9.3
1919	56,130	6.0	108,389	12.0	58,401	6.0
1921	47,935	4.7	76,018	7.5	10,756	1.1
1922	19,759	1.7	61,966	5.5	2,307	.2
1923	10,824	.9	52,676	4.4	3,266	.3

The figures in Table IV indicate that since 1917 American soap makers have not found it practicable to replace soya-bean oil with cottonseed oil. The consumption of both has declined greatly since that year. The explanation is found in the rising price of cottonseed oil relative to other oils, which removes it from the soap-maker's market and restricts its use to edible products, such as lard compound.

In the last 12 years neither peanut oil nor corn oil has furnished as much as 1.5 per cent of all the oils used in soap making. The use of both of these oils for edible purposes has tended to remove them from the soap-maker's market.

On the Engineer's Book Shelf

Industrial Stoichiometry

INDUSTRIAL STOICHIOMETRY. Chemical Calculations of Manufacturing Processes. By *Warren K. Lewis*, head, department of chemical engineering, Massachusetts Institute of Technology and *Arthur H. Radasch*, professor of ceramic engineering, New York State School of Ceramics at Alfred University. McGraw-Hill Book Company, Inc., New York. 174 pp. Price $2.50.

Reviewed by Fred C. Zeisberg

This little book of 174 pages is the first of the *Chemical Engineering Series* recently announced by the McGraw-Hill Book Co., and sponsored by a committee consisting of some of the leading chemical engineers of the country.

As stated by the authors, the purpose of this book is to teach the applications industrially of those principles of stoichiometry so commonly used in analytical work in the laboratory. Before proceeding with the more detailed consideration of the contents, however, those possible readers to whom the last two lines of the following nursery rhyme apply should be forewarned:

> Multiplication is vexation.
> Division is as bad.
> The rule of three perplexes me
> And practice drives me mad.

for the entire contents deals with an intensive application of the "rule of three," with multitudinous illustrative examples and problems for the sake of practice.

Considering the apparent limitations of the subject the authors have succeeded in producing a surprisingly readable work. Taking several of the more representative industries or chemical engineering processes, such as combustion, gas production, sulphur combustion, lime and cement manufacture, metallurgy, crystallization, etc., methods are shown for evaluating the production or consumption of materials which cannot be directly measured, drawing up material or energy balances and, in general, obtaining answers to the many questions continually arising in industrial plants, the direct determination of which would be physically impossible or impossibly expensive.

While the principles that are illustrated are exceedingly simple, their development often permits the display of considerable ingenuity. The examples are not the old hackneyed methods long used industrially, judging by at least one case in an industry with which the reviewer is familiar. This is the use, in the contact sulphuric acid industry, of a combined oxygen and sulphur balance, easily calculable from simple gas analyses, to find out how much sulphur trioxide is being formed in the burner, a figure the direct determination of which is rather difficult.

The whole aim of the authors is, as stated in the preface, to "make the head save the heels." A careful perusal of this book by those whose work brings them in contact with the quantitative handling of industrial materials cannot help but be of value, and if they themselves possess a certain amount of that ingenuity which is, after all, the main requisite in the application of the technique developed in this book, numerous applications in their own field will be at once apparent.

In typography, paper and general make-up, the volume is up to the usual high standard of the publishers. The style is, as said before, very readable, and about the only deficiency is an index which tends to be curtailed.

If the remainder of the series succeeds as well as this first volume in filling the gaps in the scanty literature in an important and growing branch of engineering science, the McGraw-Hill Book Co. may well congratulate itself on being responsible for it.

International Critical Tables

INTERNATIONAL CRITICAL TABLES OF NUMERICAL DATA, PHYSICS, CHEMISTRY AND TECHNOLOGY, VOL. I. Prepared under the auspices of the International Research Council and the National Academy of Sciences, by the National Research Council of the United States of America. Editor-in-chief, *Edward W. Washburn*, Ph.D.; associate editors, *Clarence J. West*, Ph.D. and *N. Ernest Dorsey*, Ph.D.; assistant editors, *F. R. Bichowsky*, Ph.D. and *Alfons Klemenc*, Ph.D. McGraw-Hill Book Company, Inc., New York. 415 pp. Price $12.

Reviewed by H. C. Parmelee

There is a temptation to deal in superlatives in reviewing this volume because its publication is indeed an outstanding achievement which, even before its accomplishment, commanded the approval and co-operation of the scientific world. Recalling the enthusiastic promise and high purpose with which the project was undertaken under American leadership, the result may be fairly measured by saying that Vol. I brings to fruition all the hopes and aspirations of the promoters. It is in itself an earnest of the excellence of the four volumes yet to come.

As an example of international co-operation the project probably stands alone in scientific literature. Through four years of sustained effort a distinguished board of editor-scientists, assisted by over 300 co-operating experts in the Old World as well as the New, have gathered together critical data relating to physics, chemistry and technology. The magnitude of the work is shown by its publication cost—editorial, contribution and manufacture—of more than half a million dollars. Its worldwide acceptance is evidenced by subscriptions not only from Great Britain and the principal countries of Europe and Asia, but also from Siam, Jerusalem, Tasmania, Iceland, Samoa, Liberia, Ceylon and Esthonia. Twenty per cent of the pre-publication subscriptions was from foreign countries.

The contents of Vol. I is conveniently divided into the following major sections: National and local systems of weights and measures—symbols, basic constants, conversion data, dimensions, definitions—chemical elements and atoms—thermometry—laboratory methods for producing and maintaining constant temperatures—laboratory methods for maintaining constant humidity

—barometry and manometry—psychrometry, density of moist air, change in barometric pressure with altitude —volume of liquid menisci—weights and weighing—calibration of volumetric vessels—standard buffer solutions and acid-base indicators—high vacuum technique —errors of observation.

Each of the sections and major subdivisions was compiled under the direction of a co-operating expert, of which 50 were engaged in the production of this volume. Directions for using the tables appear conveniently throughout each section, and search is greatly facilitated by means of index numbers and appropriate keys. The mechanical arrangement of the book, a neglected feature in many otherwise valuable works of reference, has been carefully planned and well executed.

As every experienced man of science knows, reference to the literature is an essential phase of research and development, both at its inception and during the progress of the work. Fundamental data are absolutely necessary to accomplishment, and on the availability and completeness of such data depends the rapidily and even the success of a given project. It is in this regard that the International Critical Tables can be of tremendous assistance in every laboratory. Viewed as a tool for decreasing waste in research, increasing individual productivity, and facilitating the solution of problems, both big and little, the research worker can ill afford to be without this compendium of information compiled critically by recognized specialists. To place a money value on such a work, other than that covering material and publication expense, is impossible.

It is obviously difficult to give due credit here to every participant in a compilation of such magnitude, but mention should be made of the Board of Editors who directed the work: Edward W. Washburn, chairman, George K. Burgess, Saul Dushman, John Johnston, S. C. Lind, Charles E. Mendenhall and Richard B. Moore. The project was sponsored by the National Academy of Science and the National Research Council, and administered by a Board of Trustees consisting of George P. Adamson, chairman, Harrison E. Howe, William M. Corse, Edward B. Craft, Hugh K. Moore, Michael I. Pupin, Julius Stieglitz and Charles L. Reese. Finally, those who are the beneficiaries of this monumental work should not lose sight of the 244 firms and individuals whose contribution of $170,000 made possible the low-price publication of the International Critical Tables.

AN INVESTIGATION OF CERTAIN METHODS FOR TESTING HEAT INSULATORS. By *E. P. Grundhofer*, assistant professor of experimental engineering. Bulletin No. 33 of The Pennsylvania State College Engineering Experiment Station, State College, Pa. 72 pp. Price 25c.

This bulletin contains a description of 4 methods of testing low-temperature heat insulators that have been used successively at the Engineering Experiment Station of the Pennsylvania State College.

The comparisons show that the guarded plate heater gives the lowest conductivity values for a given material and also gives the smallest per cent increase in conductivity with increase of mean temperature of the material. The other methods follow in order: cubical heater test box, cubical test box and Postal Department test box. Corkboard blanks of the same density and from the same shipment were used as the test material.

The appendix contains thermal conductivities of a few materials, obtained on the guarded plate heater.

Intermediates for Dyestuffs

INTERMEDIATES FOR DYESTUFFS. By *A Davidson*, B.S.C., A.I.C. D. Van Nostrand Company, New York. 250 pp. Price $11.

Reviewed by P. H. Groggins

There is probably no more fascinating field in chemistry than the synthesis of intermediates for dyestuffs, and owing to its commercial and strategic importance, it has received the most extensive and intensive investigation during the past decade. To comb adequately the mass of literature on this subject in order to select the most important information for incorporation into a text is a task of great proportions.

But this objective has here been satisfactorily attained. The author states that "The present book may be considered as in effect an elaboration of the summaries dealing with intermediates, as contained in Georgevics, Bucherer, Cain and Thorpe." It is in fact more than an elaboration, as the volume is distinctly more comprehensive and contains ample evidence that most of the recent publications in its field have been given careful consideration. References are made to specialized texts which have lately made their appearance and the incorporation of such material adds to the authenticity as well as the utility of the book.

The classification of the intermediates is based on their formation from the coal-tar crudes from which they are derived. Each product is traced step by step from the simpler substance to the more complex of each class. This scheme of course leads to inevitable duplication where products can be derived from several basic substances or by different methods from the same source. This difficulty is overcome by the use of cross references.

At the opening of 12 of the 14 chapters there is a genealogical table showing the intermediates to be considered and their method of derivation. These charts are indeed valuable in giving the student a bird's-eye view of the field and is of invaluable assistance in giving an impression of continuity and order in the vast maze of products under consideration.

The chlorobenzenes and their derivatives are treated first. Succeeding chapters discuss the derivatives of nitrobenzene, aniline, benzene sulphonic acids and phenols, toluene, xylene, naphthalene, *B*-naphthol, phthalic anhydride, anthracene and anthraquinone. Accompanying the discussion of each intermediate is a description of its physical properties and a brief reference to the class of dyes in which it plays an important part. Careful attention has been given to the descriptive nomenclature and graphic formulae that precede the technical discussion of each intermediate.

Probably the most important single contribution in the book is the inclusion of an operating index wherein the subject matter of the book is reclassified according to unit chemical processes such as halogenation, nitration, reduction, amidation, etc., etc. This index will prove of great value in the classroom as well as to the research chemist who desires to make a comparative study of the techniques used in any particular unit operation.

Although the author presents no novel method of treating his subject, he does bring within its covers a great fund of valuable information carefully arranged and edited, and the work merits consideration from those interested in the synthesis of intermediates for dyestuffs.

Introduction to Industrial Chemistry

AN INTRODUCTION TO INDUSTRIAL CHEMISTRY. By *S. I. Levy*, consulting technical chemist, with an introduction by *Sir William Jackson Pope*, professor of chemistry, Cambridge University. McGraw-Hill Book Company, Inc., New York. 288 pp. Price $4.

In "An Introduction to Industrial Chemistry," Dr. Levy has produced a new type of book. The conventional idea of attempting to canvass the whole breadth of the chemical engineering industries has been abandoned in order to stress fundamental technical and economic considerations as they apply to plant practice.

About one-half the book is concerned with control, operation, unit process equipment, general plant equipment and cost finding. This treatment, which is largely a qualitative one, is followed by a general survey of chemical engineering industries and this is necessarily brief; in fact it is merely a fully expanded outline. The last four chapters are descriptive of a selected group of industries—fuels, sulphuric acid, alkalis, intermediates and explosives—which are discussed more in detail.

A fault common to many textbooks on industrial chemistry is an attempt to describe the technology of every industry, and without regard to relative economic importance. The result is a voluminous work, unbalanced and even incomplete, the plan of which befogs the principles that should be retained by the student of industrial chemistry. For students especially, Dr. Levy has written an interesting book, and the emphasis is where it belongs—not on a mass of descriptive matter—but on operating fundamentals.

Chemistry in Agriculture

CHEMISTRY IN AGRICULTURE. Edited by *Joseph S. Chamberlain*, professor of agricultural and organic chemistry, Massachusetts Agricultural College; advisory editor, *C. A. Browne*, chief, Bureau of Chemistry, U. S. Department of Agriculture. The Chemical Foundation, Inc., New York. 384 pp. Price $1.

Hardly ever do we realize that agriculture and animal husbandry are the biggest and most fundamental of our producing activities. Farming lacks the spectacular features of the large manufacturing industries. But agriculture has not been asleep in a scientific sense, and the present popular book, written by a group of specialists, shows the remarkable progress made in the study of soils, fruits, fermentation processes, biochemistry, animal nutrition, dairying and insect control.

Formation of Powdered Copper in Anode Mud

To the Editor of Chem. & Met.:

Sir—In the note on the formation of powdered copper in anode mud in your May issue M. deKay Thompson seems to have made a slight oversight in using the equation

$$K = \frac{(Cu{+}{+})}{(Cu{+})^2}. \qquad (2)$$

The mathematical discussion may be correct but the mistake seems to consist in assuming that the copper in solution must all be in the ionic form. It is easy to show experimentally that when concentrated solutions of cuprous salts, such as one of cuprous chloride in calcium chloride, for example, are diluted, metallic copper is deposited. I have made such experiments in studies of the deposition of native copper from mine waters and have no hesitation in saying that dilution, if it occurs, may be a factor in the formation of minute crystals of copper in anode sludge, although temperature changes and mechanical disintegration may also be features of the process.

ROGER C. WELLS.

U. S. Geological Survey,
Washington, D. C.

To the Editor of Chem. & Met.:

Sir—In the note criticized by Mr. Wells, I showed that the ionic equations generally used to explain the formation of metallic copper in anode mud do not explain this phenomenon, but that a temperature drop, which is known to take place, would be a satisfactory explanation. This reaction is extremely sensitive to temperature change. According to Mr. Wells' experiments, diluting a concentrated solution of cuprous chloride causes the following reaction to take place:

$$Cu_2Cl_4^{--} = Cu + CuCl_2 + 2Cl^-,$$

and by analogy he infers that on dilution a similar reaction would take place in sulphate solutions:

$$2CuSO_4^{--} = Cu + CuSO_4 + SO_4^{--}.$$

Abel, however, has shown [*Zeit. anorg. Chem.*, vol. 26, p. 396 (1901)] that

$$\frac{CuSO_4}{(Cu_2SO_4)^2} = \text{a constant},$$

so that in the case of sulphate the same considerations would apply to the unionized salt as to the ions.

M. DEKAY THOMPSON.

Massachusetts Institute of Technology,
Cambridge, Mass.

Heating of Modern Coke Ovens

To the Editor of Chem. & Met.:

Sir—I have read the article "Heating of Modern Coke Ovens." You have made a very good presentation, but there are two points which I think we ought to correct.

On page 235 you say: "It is practically immaterial whether this figure relates to wet or dry coal, since the coal is generally coked with a moisture contents of 3 per cent, and that means that if the coal were reduced to a dry condition the heat requirements would be greatly varied." This, of course, should read: "would *not* be greatly varied."

Again, on the same page, you say: "This last factor precludes comparisons between European and American practice, as the silica refractory construction used in the United States is not yet customary in Europe." The thought Dr. Kuhn meant to convey was that, due to the uniformity of heat distribution and control in the Still oven, and the consequent avoidance of local overheating, it is not necessary to use the more expensive silica material in construction, but that it is perfectly safe to use the less expensive Chamotte material. The superior refractory value of silica is well-known in Europe, in fact, the firm of Carl Still has several such batteries in operation and under construction. It is a question of price and expediency. Here in America it is customary, with all the one-flame heated ovens, to "drive" the ovens at times, and this driving means greater local heats in the flues, calling for the very best material in construction, which is silica. The Still ovens do not have to be so driven. They give the same productive results with flue temperatures at 2,400 to 2,500 deg. F., regardless of the fact whether they are built of Chamotte or silica bricks.

C. F. SULTEMEYER.

Carl Still Combustion System,
New York City.

Recent Articles in Technical Periodical Literature

Synthetic Petroleum. By catalytic reduction and hydrogenation of CO at ordinary pressure under properly regulated conditions, a series of gaseous, liquid and solid hydrocarbons can be obtained. The gases are mainly ethane, propane, butane, etc., with only small amounts of olefines. The gasoline fraction is water white, sweet smelling, and does not discolor nor resinify. Naphthenes occur to some extent in the heavy fractions. In general, the product has the most desirable properties of the best American petroleums with paraffin base. Of course it contains no sulphur. F. Fischer and H. Tropsch, *Ber. d. d. chem. Ges.*, May, pp. 923-5.

New Motor Fuel. "Gasine" is a specially refined gasoline containing substances which make the vapor a conductor instead of a non-conductor. This anti-knock fuel is based on the recent discovery of Tern and Hloch that knocking is due to the non-conducting property of gasoline vapor instead of the causes usually assigned. By use of this principle, motors could be made with smaller and lighter cylinders yet with increased efficiency. G. Grote, *Chem. Ztg.*, April 24, pp. 289-90.

Mineral Oil Industry. A review, treating petroleum refining, gasoline production, distillation practice, cracking processes, treatment of paraffin and other products. Illustrations and descriptions of equipment are included. Robert Kuhn, *Chem. Ztg.*, Feb. 16, pp. 113-5; March 3, 17 and 31, pp. 154-6, 191-3, 227-8; April 28, pp. 303-5; May 12, pp. 338-41.

Oil Shales. The Württemberg shales yield a satisfactory amount of ammonium sulphate and also contain iodine, both of which should be utilized for profitable working of the shales. The coke from this shale is low in ash and makes an excellent fuel. The tar is high in sulphur and also contains pyridine bases. F. C. Gaisser and H. Bader, *Chem. Ztg.*, April 21, pp. 277-80.

Liquefaction of Coal. Recent progress in the Berginization (hydration) of coal and studies of the chemical structure of coal. H. Broche, *Brennstoff-Chemie*, vol. 7, pp. 140-1.

Gas Purification. In treating coke-oven gas for use as city gas, coke plants in Europe have found it profitable to recover the sulphur from the gas by oxidizing the H_2S with SO_2. The iron oxide process, favored by some American writers, is not practical on a commercial scale. The processes of Feld, Claus, Claude and Burkheiser for purifying gas are reviewed. C. Harnist, *Chim. et Ind.*, April, pp. 506-11.

Fuels for Power. The comparative advantages and disadvantages of gasoline, benzol and alcohol are discussed. Gaseous fuels are also considered. For anti-knock fuels a better agent is needed; neither tetraethyl lead nor iron pentacarbonyl is quite satisfactory. Wa. Ostwald, *Zeitschr. angew. Chem.*, May 13, pp. 594-6.

Powdered Coal. Some of the advantages of powdered coal in industry. H. Winkelmann, *Der Apparatebau*, vol. 38, pp. 90-2.

Solid Fuels. Relation between the gas content of various solid fuels and their flammability and behavior in the fuel bed. M. Dolch, *Brennstoff-Chemie*, vol. 7, pp. 133-9.

Power Economy. Comparable calculations of the cost of power from Diesel engines and from high tension alternating current. *Chem. Ztg.*, p. 301.

Tar from Low Temperature Coking. These tars are nearly totally soluble in ether and benzene. The phenolic portion consists mainly of phenol homologs; the basic portion is about 85 per cent tertiary and 15 per cent secondary bases, with no primary bases and no pyridine. The neutral portion is about ¼ saturated hydrocarbons and about ¾ higher aromatic hydrocarbons, with no benzene. The presence of about 0.1 per cent of naphthalene proves that this hydrocarbon may occur in low temperature tars. E. Parrish and F. M. Rowe, *J. Soc. Chem. Ind.*, April 23, pp. 99-106T.

Corrosion of Insulated Metals. Transformer oils and switch oils deteriorate in use; one result is that they become acid and attack the metals with which they are in contact. The cause of the oxidation which forms acids in the oils has been traced, in part at least, to water in the oils. St. Reiner, *Zeitschr. angew. Chem.*, May 13, pp. 588-91.

Rustproofing with Lead. By a new method, it is possible to spread a lead coating on iron like paint. A pyrosol of lead in lead oxide is made by heating lead in an electric furnace under closely regulated conditions. The product, very finely powdered, is then dispersed in linseed oil. Spread on a clean iron surface, this pigment yields metallic lead in a highly activated state and a film of lead forms on the iron. The coating is extraordinarily adherent. Illustrated. A. V. Blom, *Zeitschr. angew. Chem.*, May 6, pp. 555-6.

Corrosion. The selection of proper materials of construction; heat resistant metals. Th. Hoffmann; peculiar observations on corrosion. R. Stumper, *Korrosion*, vol. 1, pp. 1-4.

Electric-Furnace Cast Iron. The Duplex process of making high-grade cast iron utilizes a combined cupola and electric furnace. The method makes possible the production of high tensile cast iron from low grade scrap high in C, P and Si. The improved physical properties are imparted to the product by superheating the molten iron (1500-1700 deg.). With cheap electric power, the method can also be profitably used for making lower grades of cast iron. M. K. von Kerpely, *Zeitschr. f. angew. Chem.*, April 15, pp. 480-1.

Acid-Resistant Iron. The present state of the development of acid resistant iron. (Cont.) Th. Hoffman, *Chemische Apparatur*, vol. 13, pp. 77-9.

Materials of Construction. The application of cast iron and acid-resistant enamel in the construction of chemical equipment. (Cont.) B. Liebing, *Der Apparatebau*, vol. 38, pp. 85-7.

Celluloid. Recent progress in machinery for the celluloid industry. F. Kiefer, *Kunststoffe*, vol. 16, pp. 91-2.

Natural and Synthetic Resins. A review of the production and the chemical and physical properties of natural resins and of the phenol-formaldehyde, cumarone, aldehyde and urea-formaldehyde types of synthetic resins. More than a hundred literature references are cited. J. Scheiber, *Zeitschr. angew. Chem.*, May 6, pp. 545-54.

Nitrogen Fixation. Cheap hydroelectric power in the Pacific Northwest should favor commercial production of nitrogen compounds. In experiments at the University of Washington, a satisfactory laboratory furnace (high tension arc) was constructed and was found to have good energy efficiency. It was used in a study of the equilibria obtained with various mixtures of nitric oxide and oxygen, and of the most favorable conditions of pressure, gas velocity and concentration. Herman V. Tartar and M. F. Perkins, *J. Phys. Chem.*, May, pp. 595-616.

Selenium Recovery. Fuming sulphuric acid (or Caro's acid, if cheap enough) is a very satisfactory reagent for recovering Se from lead chamber sludge. If the procedure is followed as described, the Se comes out purer than in other processes; it contains no alkali salts and no fixed matter. W. Stahl, *Chem.-Ztg.*, April 21, p. 280.

Bromine from Sea Water. Brines, concentrated by natural or artificial evaporation, are treated with chlorine and extracted with CCl_4. The extract is treated with lime. The resulting bromide of lime is easy to recover and is very stable, in addition to having a satisfactory content of available Br. Annibale Moreschi, *Giorn. chim. ind. appl.*, March, pp. 115-6.

Raw Materials. Germany's production of raw materials for the chemical industry before and after the war. H. Bausch, *Z. angew. Chemie*, vol. 39, pp. 530-3.

Refractory Materials. The quality, fabrication and chemical composition of refractory materials. J. Dautrebande, *Rev. Chemie Industrielle*, vol. 35, pp. 113-6.

Electrolytic Sodium. Improvements in the process for electrolytic production of sodium. H. Danneel, *Chemische Apparatur*, vol. 13, pp. 90-1.

Distilled Water. Description of modern plant equipment for the production of distilled water. *Chem. & Ind.*, vol. 45, pp. 297-9.

Sheep Leather. Much of the trouble in preparing sheep skins for tanning is due to faulty curing. Common errors are insufficient cleaning and undercuring, with improper soaking after curing. A preferred procedure is described. Studies of painting, liming, drenching and pickling are under way. G. D. McLaughlin and E. K. Moore. *J. Am. Leather Chem. Assocn.*, June, pp. 274-80.

Unshrinkable Wool. The process of rendering wool unshrinkable by chlorination is very difficult to control. Sufficient treatment to make the wool satisfactorily unshrinkable easily causes serious damage to the fibers. Chlorine does more damage than hypochlorous acid. Experiment shows that the action is quite complex, and in a properly treated wool the amount of chlorine which enters into actual chemical combination is very small. Better under-

standing of the reaction would lead to improved control of the process. S. R. Trotman and E. R. Trotman, *J. Soc. Chem. Ind.*, May 7, pp. 111-5T.

Transport of Materials. Steam shovels, cranes, loading and unloading machinery and like devices are illustrated and described with reference to special uses in the chemical industry. *Chem.-Ztg.*, April 14, pp. 261-3; April 28, pp. 301-3.

Magnetic Separators. Principle of magnetic separation; types of separators and their uses in metallurgy and in the processing of various materials. Illustrated. B. I. Rolling, *J. Soc. Chem. Ind.*, May 14, pp. 344-5.

Standard Screens. A standard table for wire screens is proposed for British use. It is compared with the standard sieve series of the U. S. Bureau of Standards and table of screens of the Institute of Mining and Metallurgy. Screens in each of the proposed series are illustrated by photographs. O. C. Ellington, *J. Soc. Chem. Ind.*, May 7, pp. 128-34T.

Agitators and Mixers. Various devices are illustrated and described. Aluminum is recommended for mixing vats wherever it can be used, since it needs no coating and has other desirable properties. For high acid concentrations, keramonite (a ceramic ware with metal inserts, similar to wire glass) is especially useful. E. Belani, *Chem.-Ztg.*, May 12, pp. 337-8.

Filtration. The application of cotton filter cloth considered from a theoretical and practical point of view. L. Stein, *Chemische Apparatur*, vol. 13, pp. 81-3.

Roasting Kilns. A discussion of various types of roasting kilns considering recent developments in the field. B. Schapira, *Chemische Apparatur*, vol. 13, pp. 92-94.

Match Industry. A review of the world's production of matches with special reference to the countries engaged in this industry. *Die Chemische Industrie*, vol. 49, pp. 337-44; 360-7.

Canada's Chemical Industry. A review of recent progress and present state of Canada's chemical industry written by experts in the various fields. *Canadian Chem. & Met.*, vol. 10, pp. 99-115.

Government Publications

Prices indicated are charged by Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free.

Properties of Potters' Flints and Their Effects in White-Ware Bodies, by E. E. Pressler and W. L. Shearer. Bureau of Standards, Technologic Paper 310. 15 cents.

A Study of Case-Lining Papers for the Purpose of Developing Standard Specifications, by B. W. Scribner and F. T. Carson. Bureau of Standards, Technologic Paper 312. 5 cents.

Nonflammable Liquids for Cryostats, by C. W. Kanolt. Bureau of Standards, Scientific Paper 520. 10 cents.

Measurements of the Index of Refraction of Glass at High Temperatures, by C. G. Peters. Bureau of Standards, Scientific Paper 521. 10 cents.

Strain Lines Developed by Compressive Tests on Structural Members of the Delaware River Bridge at the U. S. Bureau of Standards for the Delaware River Bridge Joint Commission. Bureau of Standards, Miscellaneous Publication 72. 5 cents.

Some Technical Methods of Testing Miscellaneous Supplies, Etc. Bureau of Standards, Supplement No. 2 to Miscellaneous Publication 15.

Rubber Specifications: U. S. master specifications in Bureau of Standards Circulars, as follows: No. 305, rubber tubing; No. 306, rubber matting; No. 307, pneumatic hose; No. 308, rubber stoppers.

Safety Rules for the Installation and Maintenance of Electric Utilization Equipment. Bureau of Standards, Handbook No. 7. 15 cents.

A Carbon Monoxide Recorder and Alarm, by S. H. Katz, D. A. Reynolds, H. W. Frevert and J. J. Bloomfield. Bureau of Mines, Technical Paper 355. 10 cents.

Flotation of Limestone from Siliceous Gangue, by Oscar Lee. Bureau of Mines, Serial No. 2744.

Tests and Characteristics of Dust Respirators, by S. H. Katz, G. W. Smith and E. G. Meiter. Bureau of Mines, Serial No. 2745.

Study of the Reactions in an Iron Blast Furnace, by S. P. Kinney, P. H. Royster, and T. L. Joseph. Bureau of Mines, Serial No. 2747.

Nomographic Charts for Computing the Rate of Leakage from Natural Gas Lines, by E. O. Bennett. Bureau of Mines, Serial No. 2751.

Record of the Pittsburgh Testing Station Standard Dynamite, by S. P. Howell. Bureau of Mines, Circular No. 6004.

Manufacture and Characteristics of Gasoline, by A. J. Kraemer. Bureau of Mines, Circular No. 6006.

Mineral Statistics for 1925—Preliminary estimates in mimeographed form from Bureau of Mines on: Crude Platinum; Primary Lead and Lead Pigments.

Coloring Citrus Fruit in Florida, by William R. Barger and Lon A. Hawkins. Department of Agriculture, Department Bulletin 1367.

Effects of Applied Research upon the Employment Opportunities of American Women. Department of Labor, Bulletin of the Women's Bureau No. 50. 10 cents.

Foreign Trade Bulletins. A list of publications of the Bureau of Foreign and Domestic Commerce, March, 1926.

Coke and Byproducts in 1923, by F. G. Tryon and H. L. Bennit. U. S. Geological Survey Mineral Resources pamphlet.

Miscellaneous Publications

Clays and Shales of Michigan and Their Uses. State of Michigan, Geological Survey Division, Publication 36. Price $1.25 postpaid.

An investigation of the Translucency of Porcelains. by Cullen W. Parmelee and Pierce W. Ketchum. Bulletin No. 154, Engineering Experiment Station, University of Illinois, Urbana, Ill. 15 cents.

Service Conditions of Refractories for Open-Hearth Steel Furnaces, by B. M. Larsen, F. W. Schroeder, E. N. Bauer and J. W. Campbell. Mining and Metallurgical Investigations under auspices of Carnegie Institute of Technology, U. S. Bureau of Mines and Mining and Metallurgical Advisory Board. Carnegie Institute of Technology, Pittsburgh, Pa. $1.50.

Mineral Resources for Future Populations

In a pamphlet by this title, F. G. Tryon and Lida Mann of the Division of Mineral Resources, U. S. Geological Survey have reviewed the outlook for mineral supplies in the United States. The authors say, "The immediate outlook for mineral supplies in the United States is encouraging. The ultimate outlook is discouraging. For the immediate future our resources are sufficient to support an increasing population at a rising standard of living. But they are apparently not sufficient to support permanently even our present population at present standards, unless science should discover some source of energy not now available."

Some of the resources and problems that are reviewed critically are the metals, particularly iron, copper and lead; coal; petroleum; mineral materials of construction; timber; economics of energy production and mining.

The pamphlet is one of 19 chapters of "Population Problems in the United States and Canada," which is vol. 5 of the Pollak Publications, issued by the Pollak Foundation for Economic Research, Newton, Mass.

List of Commercial Testing Laboratories

In recognition of the desirability under present conditions of independent commercial testing service and in anticipation of a marked increase in the demand for such service in both domestic and export trade, the Bureau of Standards is making as nearly complete and accurate as possible its list of laboratories throughout the country that are prepared to test various kinds of commodities to determine whether or not they comply with purchase specifications. In this list will be included the laboratories of universities and colleges that are equipped for doing commodity acceptance testing on either a purely commercial basis or for the purchasers of the States, municipalities, public institutions, or the schools themselves.

Heretofore purchasers not individually equipped to make their own acceptance tests have been reluctant to adopt the specification method of buying commodities because of the fixed belief that many manufacturers work off "seconds" on such customers. The knowledge that they can at any time, when they so desire, call upon testing laboratories to check the deliveries made to them on contracts based on specifications with which certificates have been issued by the manufacturers will induce a large number of such purchasers to take full advantage of the certification plan.

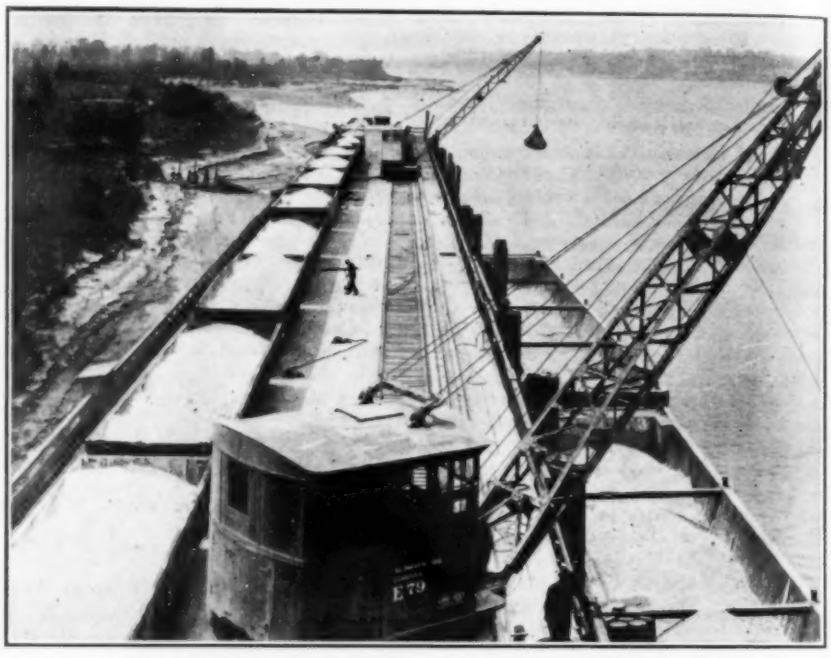
The Plant Notebook

An Exchange for Operating Men

Large Saving Made by Using Mixed Flow Turbine

A large manufacturing concern recently installed a mixed flow turbine of 750 kw. capacity. This is a three-stage turbine and the exhaust steam from other equipment in the plant is fed to the second stage. Formerly all the current used was purchased from an outside source. At present, part of the current required is purchased in addition to that generated by means of the turbine. The present power cost is based on the total cost of purchased and generated current.

Under old conditions, when all current was purchased, the cost averaged 3¼ cents per kw.-hr. With the new equipment the cost is 1½ cents per kw.hr., resulting in a saving of 2 cents per kw.-hr. This saving, in one year, amounted to $39,660 and, on this basis, it is expected that the total cost of the new power plant and equipment, including new a.c. motors in the factory, will be saved in 3¼ years.



Unloading Sulphur from Barges at a Mississippi River Chemical Plant
The use of steel barges of this type for handling bulk chemicals marks a new departure in chemical plant handling methods

How One Plant Solved a Draft Problem

By A. T. Newell
Moundsville, W. Va.

At a certain smelter two roasting furnaces were connected by means of a cross-over flue, from which a single large flue carried gases to the sulphuric acid plant. Draft was originally induced by a single acid-resisting fan with rated capacity of 6,886 cu.ft. per minute at 450 r.p.m. and 1 in. total pressure.

The draft on the furnaces was insufficient and the smelter operator made the not obvious error of installing a duplicate fan with the expectation that two fans pulling from the same flue would handle double the volume of one. After the installation was made the draft was still inadequate and several thousand dollars were spent in corrective devices which did not secure the desired results.

A formula was then discovered in Kent's Mechanical Engineer's Pocket-Book applying to the ventilation of mine shafts with fans:

$$Q = \sqrt[3]{A^3 + B^3}$$

where A is the volume of air handled by the first fan alone,
B is the volume of air handled by the second fan alone,
and Q is the volume handled by both fans pulling together from the same shaft.

This formula indicated that the addition of the second fan increased the volume of air handled not by 100 per cent but by only 26 per cent.

To check this formula as applied to two fans pulling from the same flue, readings were taken at the sulphuric acid plant by means of Pitot tubes. The first fan alone handled 7,480 cu.ft. per minute, while the second alone handled 6,940 cu.ft. per minute. Inserting these values in the above formula, the theoretical volume that should be handled by both fans working together is 9,094 cu.ft. per minute. Pitot tube readings, although somewhat inaccurate under the conditions of the test, showed a total volume of gas handled by both fans operating together of 8,910 cu.ft. per minute which is within 2 per cent of the theoretical according to the formula.

The correct solution of the above draft problem appears to have been, therefore, to construct individual flues connecting each furnace with its own fan in which case full capacity would have been obtained from each fan.

Aluminum Paint and Transformers

The manufacturer of a transformer oil recently received from a customer some samples of oil that had failed. On analysis this oil was found to be dirty, being contaminated with a small amount of very fine aluminum.

On reporting this matter to the customer, the manufacturer received in reply a letter stating that the transformer tank had recently been painted with aluminum paint by means of a spray gun. At the time of the painting the breathers of the transformers were open and no doubt some of the finely divided aluminum carried in the atmosphere was thus taken into the transformers.

This suggests that it would be wise in using aluminum or any other paint in a spray gun to see that all equipment which might be subjected to interior damage by the presence of foreign matter is carefully closed off.

Diazo Compounds Cause Skin Disease

By Raymond L. Drew
168 Delavan Ave., Newark, N. J.

Once in awhile a worker, employed in the diazo buildings of aniline color plants, is affected by a peculiar skin disease which takes the form of an irritating rash that causes the skin to blister quite severely. One of two men, working side by side, may be so affected that he will have to discontinue work in that department while the other will show no signs of the ailment. It is difficult to give a reason for this varying sensitiveness of workers to this poison. Probably it is the same reason that causes some people to be attacked by ivy poisoning, and others not, as this rash is quite similar to poison ivy.

At first this disease is in the form of a very slight rash with considerable itch, but as it develops the skin becomes blistered, the itch still continu-

ing. In the most severe stages the blisters break and continually emit pus, which if allowed to come in contact with other parts of the skin will spread the blisters to those parts. In some severe cases the secretion from the blisters will keep the affected part of the skin continually wet, making it very difficult to check the spread of the blisters. After one attack of this poison the skin is rendered very susceptible to further attacks, and for this reason, anyone who has been bothered with the rash must be careful about entering buildings in which diazo compounds are handled. Every precaution should be taken to avoid coming in contact with any of the dry material which may be spilled on the sides of the tanks, on the floors, or on the machinery, as it is a fact that the poisoning is only contracted by coming in physical contact with the diazo compounds, since only the exposed parts of the skin are affected. The greatest danger, and one almost impossible to avoid if the person must enter the building, is from suspended particles in the air.

I have in mind a person who, for several years, worked in a building in which sulphanilic acid was diazotised, and was never troubled in the least. In fact, he felt that he was immune from the action of the diazo compounds, when suddenly the exposed parts of his skin became poisoned. The disease progressed rapidly to its most severe stage, numerous treatments being tried all the while without checking the trouble, until finally the man had to discontinue working in that building. Immediately his skin cleared up, without leaving any signs of the disease. It never has come back except when he had gone into the diazo building. This he has done on several occasions, but always with the return of the rash, even though his stay in the building had been as short as one hour.

The writer was once bothered with this itch after working with some diazotised aniline compounds in the laboratory. In this case the infection became very severe in one spot, and spread from this spot, as usual, before being checked. This attack left a scar at its starting point, the severe spot, which has never disappeared. It is the only case that I know of where a scar or mark of any kind was left on the skin after the disease had disappeared.

The safest and quickest cure for this poisoning is the removal of the affected person from the vicinity of the diazo compounds. This is not always convenient, and since the itch seems such a simple ailment at the start, a treatment of some kind is usually tried. Oil salves and ointments of the lanolin type are of no value for treatment of this skin infection as they seem to encourage the spreading of the disease. If the blistered part of the skin and a little of the surrounding clear skin is covered with lanolin, the blisters will soon spread over the clear skin. Powdered boric acid was found to be about the best agent for drying and checking the spread of the blisters. In fact nothing else seemed to help the cases mentioned here at all. It seems to fill the pores and prevent the poison compounds from entering the skin. When the rash appears on the arms and wrists, light bandages over these parts when working in the diazo building will check the itch so that it will soon disappear.

The face and hands usually give the most trouble, and by the time the worker is ready to go home, in the evening, they are at their worst, causing much discomfort from the continual itch and secretion of the blisters. By morning the condition will have cleared up somewhat and remain so until about noon, if the worker stays in the department that long, when it will grow worse again, as before. After a day and night out of the plant the trouble usually disappears, only to return again on going back into the diazo building.

Just lately a treatment which seems to help considerably in checking this itch, if not entirely curing it, is being tried. Before starting work in the morning, the face and hands are thoroughly covered with a powder made of equal parts of boric acid and talc. At noon this is washed off and at the same time the face and hands are washed with soap and water. Another application of this powder is used for the afternoon, which is of course washed off before going home. So far this treatment has shown excellent results, and in one case it is practically curing the trouble although the patient has not been moved from the vicinity of the troublemaker.

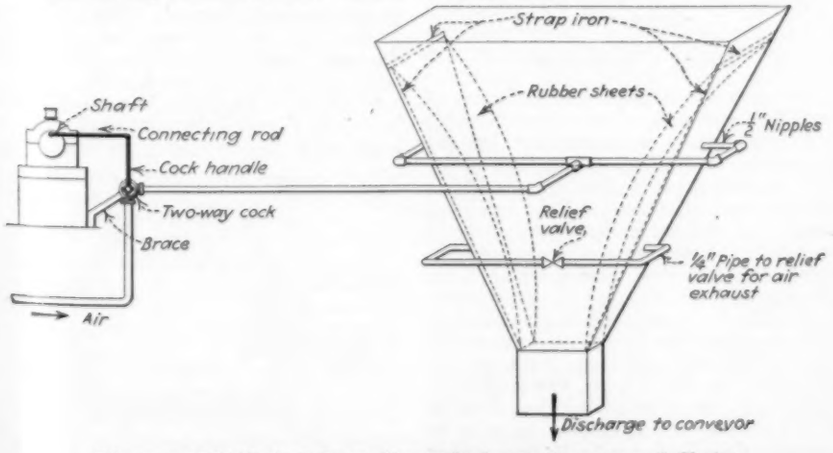


Diagram of Method of Preventing Bridging in Hoppers and Chutes
This simple, inexpensive arrangement saved much worry and expense formerly experienced from material hanging up in the hopper

Method of Preventing Bridging In Chutes or Hoppers

By Maurice C. Cockshott
5428 Harold Way, Hollywood, Calif.

In the operation of a chemical plant, much trouble was experienced with dried borax sticking in a hopper leading from an elevator to a belt conveyor. The sides of the hopper were pitched as steeply as possible but the trouble still continued to such an extent that in a very short time the passage was entirely choked. Lining the sides with polished tinned sheets was tried and was successful for a day or so until the surface was destroyed, when the trouble recommenced. I tried sheets of glass with the same result, and a small agitator driven from the head pulley of the elevator served no better.

Finally I hit on the idea of a palpitating air cushion and one was constructed, as can be seen in the accompanying figure, as follows: The hopper was remodelled so that it had but two pitched sides, the other two being vertical. These sides were covered with a loosely fitting lining of thick sheet rubber, attached at the edges with thin strap iron and stove bolts, so that a leakproof air cushion was formed. In the outside of the center of each sloping side of the hopper a ½ in. pipe nipple was welded and the two were connected with a pipe header. Also, ¼ in. nipples were welded in near the bottom edge and these also connected with a header. A small relief valve was connected to the ¼ in. line, relieving to the atmosphere.

For the inlet, a two-way cock was set up at some distance away where power to operate it was available from a convenient line-shaft. This shaft had a stub end that projected from a hanger bearing, which was converted into a crank, as shown in the figure, by drilling in its end a ¼ in. hole about 1 in. off center. A tap bolt was screwed into this hole to serve as the crank pin. To connect this to the cock, an extension handle was made from a piece of bar, one end being upset and a square hole broached in it to take the end of the plug of the two-way cock and the other connected to another short bar with a hole in the opposite end of such a diameter that the tap bolt was an easy fit. This bar was in reality a connecting rod by means of which the rotary motion of the shaft was changed into a reciprocating motion at the cock handle.

It was necessary to adjust the stroke by means of the tap bolt, several more holes being drilled in the shaft end. The angularity of the rod also had to be adjusted. These adjustments, coupled with a correct setting of the relief valve, made it possible to obtain a fairly steady pulsation or palpitation of the rubber sheets. The weight of the falling borax was sufficient to expell the air and the force of the entering air, when the cock was opened, expanded the cushion, which was thus kept in a state of continual motion. Abrasive action on the cushions was slight, one set lasting over three months in constant service, while the cost of renewal was so small as to be practically negligible.

Equipment News

From Maker and User

Resistance Welder

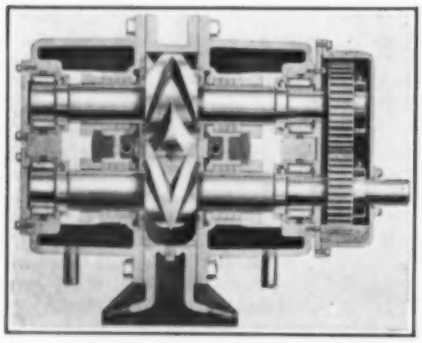
The General Electric Co., Schenectady, N. Y., has recently placed on the market two automatic resistance welding machines, one for straight seam work and the other for circular seams. These machines consist of a framework for holding the pieces to be welded, a transformer for supplying current to the electrodes, movable electrode wheels and control.

The machines are particularly designed for making light metal containers such as cans and drums and are only suitable for making lap joints in relatively thin metal. Advantages claimed are the absence of fumes and open arcs, thus making the use of masks unnecessary and the fact that the operator requires no special training to operate these machines. Welding speeds obtained vary from 20 to 100 in. per minute depending on the nature and thickness of the material worked. Material up to maximum thickness of ¼ in. can be used.

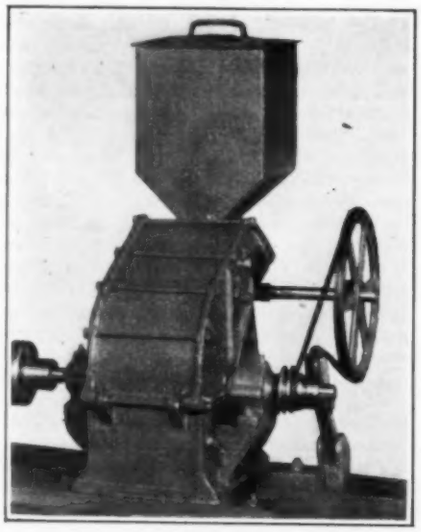
Rotary Pump

The Kinney Mfg. Co., Boston, Mass., has developed a rotary pump that is said to give a continuous discharge without pulsations. The pumping members consist of two cylindrical rotors on the surfaces of which are cut double helical blades, reversed, as shown in the accompanying illustration, at 120 degree phases. These blades are separated by channels of equal width so that the blades of one rotor fit into the channels of the other and vice versa.

These pumps are built for engine, motor or belt drive, in displacements, per 100 r.p.m., from 2.55 to 457 at speeds from 600-1,150 to 200-400. The working pressures range downward from 200 lb. for iron pumps and 125 lb. for bronze pumps. All liquids can be handled and the pump is particularly put forward for service with such materials as hot oils.



The "Heliquad" Rotary Pump
In this view the discharge is toward the front and the two rotors revolve in opposite directions toward the center



Small High Speed Hammer Mill

Small Hammer Mill

A high speed hammer mill of the screening type for laboratory or similar service is being marketed by Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo. This machine is of welded construction and has a copper gasket between the two halves of the casing to render it dust tight. Screens of twilled Monel metal, from 10 to 100 mesh are used.

The drive is a direct-connected ½ or 1 hp. motor, depending on the service, with a speed of 3,500 r.p.m. Dust-proof stuffing boxes are supplied for the shaft. Feed is of the positive screw type. The mill will handle all soft or semi-soft materials, with a capacity up to 100 lb. per hour depending on the fineness required and the hardness of the material being ground. Provision is made in the design for easy cleaning.

Skid Platform

For use with lift-truck systems of handling material, a new type of skid platform has been introduced by the Stuebing-Cowan Co., Cincinnati, Ohio. This platform is called the Stuebing Steel-Bound Platform. The principal feature of the new design is the method by which the wooden top is clamped between the two steel angles which form the frame in a manner to give great rigidity and strength. It is also claimed that the platform is readily convertible into many different types such as the bin type, the stake type, the rack-and-table type, or other styles that may be found useful. It is said to be able to accommodate loads up to 10 tons under certain conditions and to have an extremely low maintenance cost.

Pneumatic Sweeper

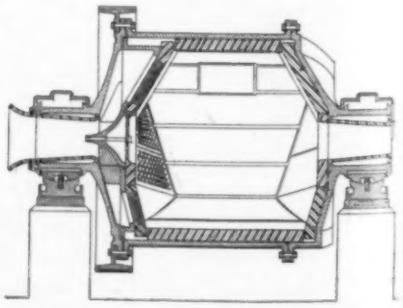
A dirt removal system that removes, conveys and collects dust in one operation has recently been placed on the market by Allen & Billmyre Co., Inc., New York, N. Y. The system is called the "Tabco." It is electrically operated and is similar to the ordinary domestic vacuum cleaners except that it is much more powerful and has a very large capacity.

Multi-stage centrifugal blowers are used and are driven by Westinghouse motors. Units are available in sizes of ½ to 50 horse power. This system is put forward for the cleaning of dust and other dirt from all types of factories.

Cylindrical Ball Mill

A cylindrical mill using less power, in which it is claimed that increased grinding and decreased ball and liner wear occurs, has been placed on the market by the Williamson Co. of San Francisco, Calif. It is being manufactured in various types, to meet specific conditions. An illustration of the grate-type mill is shown herewith. It will be noted that the ends are of special design, constituting the main feature of novelty. Ball movement occurs from the ends toward the center and vise versa. The grinding media are thrown together into a centralized cascade, and at the same time a vigorous flow is taking place from this centralized mass to the ends of the mill. This results in great complexity of movement, balls and material being in continuous circulation throughout the unit. The large and small balls are thoroughly mixed, and the material to be ground is thoroughly mixed with them. The direction of movement of the balls, and also the relative movement between the balls and material, is continuously varied. The grinding media are carried upward over the shortest course, traveling downward over a greatly increased path.

Slippage of the balls immediately adjacent to the shell is prevented without impairing the vigorous activity that



Ball Mill With Grate Type Discharge

prevails throughout the charge. The effective diameter of the mill, as well as the depth of the grinding charge, is substantially the same at the ends as at the center of the mill. The grinding media are always adequately surrounded with an ample supply of material to be ground; and the finished product, as it is liberated, travels rapidly to the discharge end of the mill, where provision is made for its immediate release.

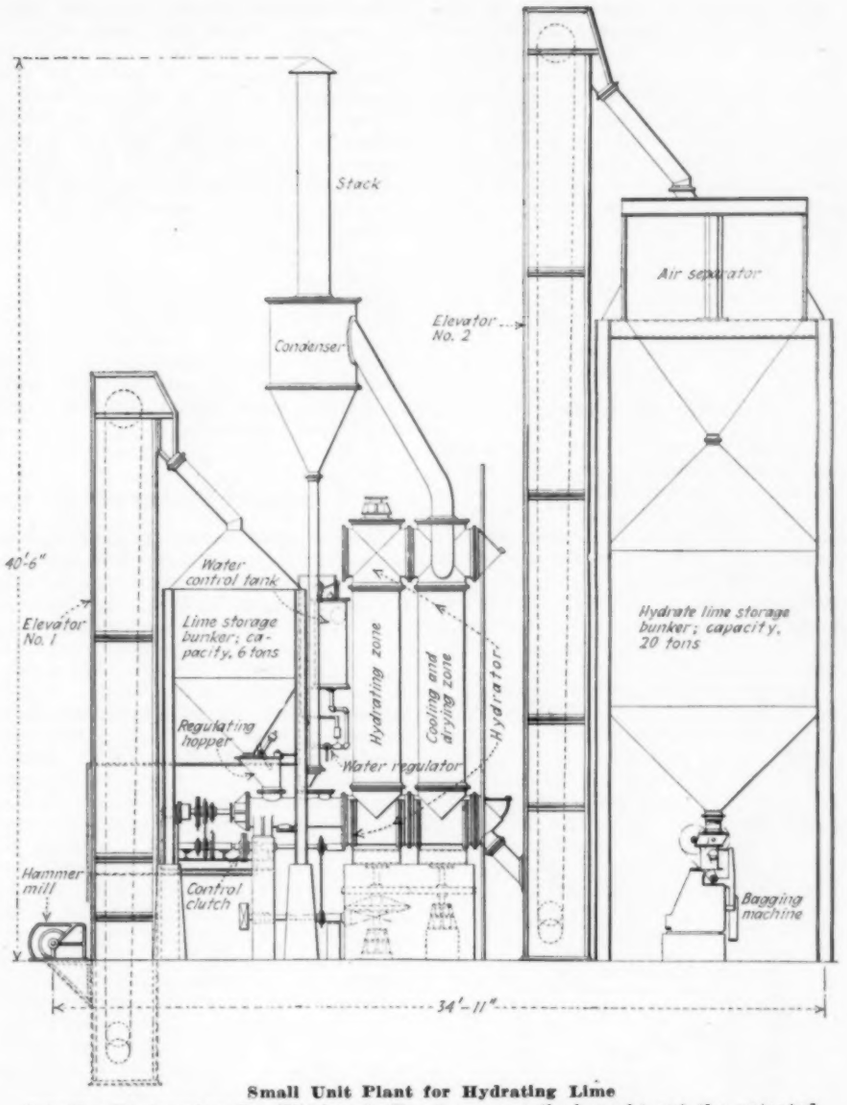
Electrical Equipment

Among the new items of electrical equipment recently brought out by the General Electric Co., Schenectady, N. Y. is a new control panel for use in two speed motors, bearing the designation CR-7107-H-1. This device, primarily designed for use with the drive of baking machinery and similar devices, consists of two contactors mounted back to back. A temperature overload relay is connected to each contactor thus giving overload protection to the motor at either speed. One of the contactors has four poles and the other six, one pole of each being used as a holding interlock.

Another new item of equipment is a lever operated master switch for work where exceptional strength and durability are important factors. This switch is particularly suitable for grouping and for operation by one man. It is designated C-3003 in the CR-3012 series of control. It is flat and semicircular in general shape, consisting of a cast iron frame and cover totally enclosing the mechanism. The handle is of the vertical type operating through a radius of 40 deg. on a one point switch and through a radius of 100 deg. on a three point switch. This handle is mushroom-shaped so that it may be grasped easily and quickly. The operation from one position to another is free, there being no friction surfaces other than the bearings and contact fingers. The handle is held in the "off" position by a spring roller device.

A new line announced by the General Electric Company consists of a completely standardized line of drum controllers embodying new features of construction and comprising units for general purpose, crane hoists, or machine applications, for either direct or alternating currents. In each group several sizes are provided to cover a wide range of motor ratings; the smaller sizes being suitable for wall mountings and the larger for floor mountings. Among the advantages claimed for this line is the skeleton type of frame used, consisting of a cast top plate and base to which are riveted rectangular steel bars, making it unnecessary for the back of the switch to function as a frame for holding the top and bottom together. As a result, the switch is accessible from both back and front. Another feature is the interchangeability of operating handle mechanism. A vertical operating lever or spring return mechanism may easily be substituted for the horizontal lever with which the switch is equipped by using another dial plate. New style self-aligning contact fingers are used. By standardizing the renewable copper tips for all switches of the same capacity repair part stocks are reduced to a minimum. Where cross-arcing is likely to occur, adequate preventative barriers and blowouts are provided. Auxiliary contact fingers are provided for control circuits to the line protective switch. The arrangement of these circuits is designed to suit the service requirements of the installation.

Among the industrial control devices are a new resistor terminal, an external relay reset, a relay installing wrench and a new relay mounting panel. With the exception of the resistor terminal this new equipment is designed to facilitate the use of temperature overload relays. The resistor terminal comes in one size for all currents up to 225 amperes. It is so designed that soldering is unnecessary in securing stranded cable. The other three items of control are for use in installations where the starters do not incorporate temperature overload relays. In these cases the panel mentioned above is used and the overload relay is mounted on it. This panel is equipped with a new resetting feature which allows external resetting by means of a cord. With this equipment a special installing wrench so designed that danger of damage to thermostatic strips is minimized, is delivered as part of the control equipment.



Small Unit Plant for Hydrating Lime

Schaffer Engineering Co., Pittsburgh, Pa., have recently brought out the patented, unit hydrating plant shown in the above drawing. The capacity is 4 tons per hour minimum. The horsepower required is 40. This plant is said to produce a high grade product for low first cost and operating expense

Distant-Reading Recorder

The Taylor Instrument Companies, Rochester, N. Y., have recently placed on the market a new distant-reading electric transmitting recording thermometer or pressure gage. In this device, motion from a standard recording thermometer tube system is transmitted through a linkage to the moving rotor of a self-synchronizing motor in the sending instrument. The sending instrument is connected electrically with an outside source of alternating current of 110 or 220 volts, and with three starter connections and two rotor connections to the receiving instrument at a remote point. The receiving station has a pen arm and pen mounted directly on the rotor of a similar self-synchronizing motor and the pen operates over the revolving chart driven by a clock mechanism.

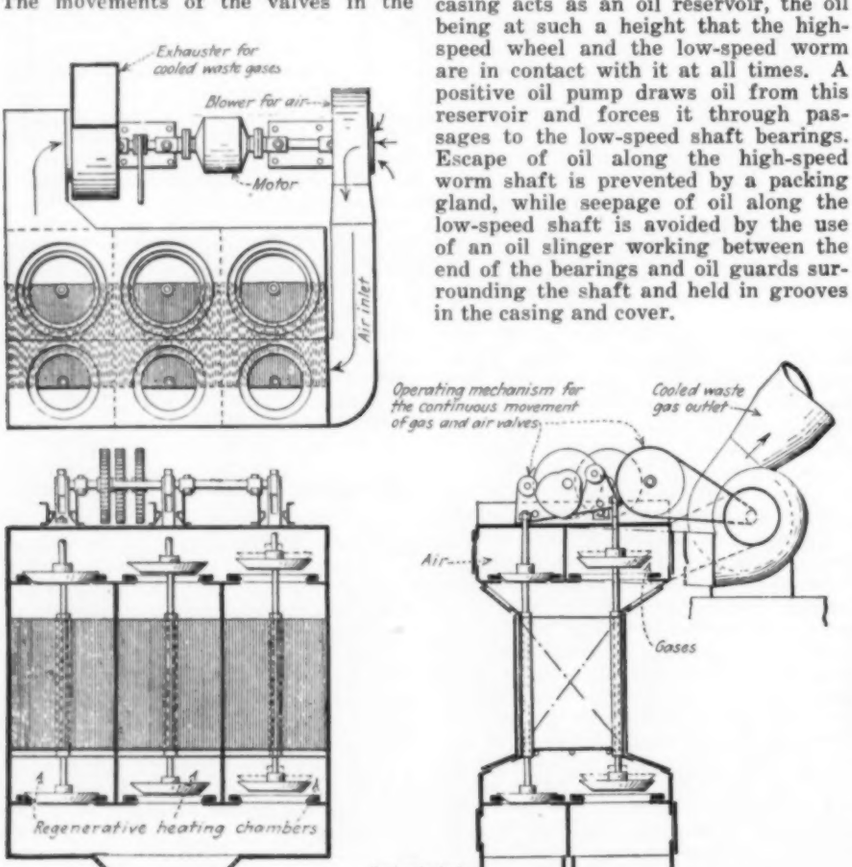
The method of operation is as follows: As the temperature of the bulb fluctuates the coil on the tube system within the case opens or closes and its motion is transmitted to the sending motor causing the rotor to revolve. This rotor being connected electrically with the rotor of the receiving station causes the latter to assume exactly the same position as that in the sending instrument. In this way the pen is caused to take the correct position and the record is made at the distant station exactly as it would be made at a recording instrument placed at the position of the sending instrument.

Air Heater

An air heater of the continuous regenerative type has been developed by Blaw-Knox Co., Pittsburgh, Pa. It consists of three compartments each containing steel plates for absorbing and transferring heat, valves for the admission of hot gases and air to the compartments intermittently, regulating mechanism, and piping for conducting the hot waste gases and air to and from these compartments.

The valves are operated by cams and are so timed that for a 60 degree turn of the camshaft the valve is opening, for 60 degrees it is open, for 60 degrees it is closing and then for 180 degrees it is closed. The gas valves work opposite to the air valves, as can be seen from the accompanying drawing, which clearly shows the method of operation. The movements of the valves in the three chambers are so regulated that at any one instant the total opening corresponds to one full valve opening. Therefore the flow of gases in one direction and of air in the other is continuous and unimpeded, and the valve motion is so slow that no shocks are caused. Cleaning doors are provided in the chambers and in the flues, and there are also doors for inspecting and replacing the steel plates.

It is claimed for this heater that leakage is small, being practically limited to the free volume of the chambers, lost at each reversal, or about 2 per cent of the air. It will preheat the air to within about 125 deg. of the inlet temperature of the gases. There are eight sizes, from 5,000 to 130,000 lb. of air per hour capacity.



Sketch of Regenerative Air Preheater

Speed Reducer

A new speed reduction gear of the worm type for ratios exceeding 100 to 1 has recently been brought out by the De Laval Steam Turbine Co., Trenton, N. J. This reducer makes the reduction in two steps and is available in ratios up to 8,000 to 1. A single casing carries all bearings for the reducer which permits of accurate and permanent alignment. The two worm shafts are carried on ball bearings. End thrust and bending strains from the driving and driven machines are avoided by the use of flexible couplings of the pin and rubber bushing type. As is usual in reducers made by this company the casing acts as an oil reservoir, the oil being at such a height that the high-speed wheel and the low-speed worm are in contact with it at all times. A positive oil pump draws oil from this reservoir and forces it through passages to the low-speed shaft bearings. Escape of oil along the high-speed worm shaft is prevented by a packing gland, while seepage of oil along the low-speed shaft is avoided by the use of an oil slinger working between the end of the bearings and oil guards surrounding the shaft and held in grooves in the casing and cover.

Stoker

The Combustion Engineering Corporation, 43 Broad St., New York, N. Y., have recently introduced a new stoker called the Green Forced Draft Stoker. This stoker embodies the principles used in the Green natural draft type. It is particularly suited to localities where the available fuel is a free burning bituminous or lignite.

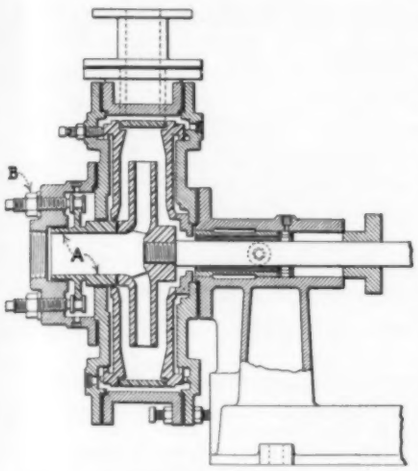
Vacuum Evaporator

Concentrators Co., 216 Pine St., San Francisco, Calif., is now marketing the Peebles design of vacuum evaporators in single and multiple effect types. The design and operation of this equipment are completely described in the article "Economical Use of Sulphite Liquor" by A. W. Allen, *Chem. & Met.*, pages 928 to 930, December, 1925.

The principal features of this evaporating system are:

1. The liquor to be evaporated is heated, under increased pressure, external to the vacuum chamber.
2. The liquor is under controlled mechanical circulation.
3. The heated liquor is subjected to flash evaporation, away from the source of heat, and therefore cools when it evaporates.
4. Evaporation is effected by a cycle of predetermined time and temperature conditions, which are under control at all times.
5. The greater part of the liquor is held, during the evaporation, at a temperature too low to cause decomposition of organic matter; while a small part of the liquor is being subjected, only momentarily to a high temperature for a period of time too short to cause decomposition of organic matter.
6. No evaporation can take place in the liquor while it is being heated. It is, therefore, impossible to concentrate the liquor during its heating to a point beyond the saturation point of its contained salts. Thus, no incrustation of salt occurs in the heater tubes.
7. Controlled circulation prevents sluggish movement of the liquor over the heating surfaces. For this reason there is no local overheating of the liquor and no building up of precipitated salts occurs on the heating surfaces.

Among the advantages claimed for this evaporating system are the following: purity of concentrate, density of concentrate, freedom from fouled heating surfaces, evaporating efficiency, evaporating capacity, elimination of entrainment losses, separation of salts in solution, compactness of the unit, simplicity of operation, economy of maintenance, and ease of recovery of condensate. These evaporators are recommended by the maker for the handling of any industrial liquor where it is desired to remove water, or some liquor containing volatile solvents, with or without the recovery of the removed liquid, for producing high density of concentrate of high purity, for separating salts from solution, or to concentrate organic liquors which are supersensitive to heat.



Cross-Section of Lined Centrifugal Pump
A is the suction-pipe liner, adjustable by means of the bolts *B*

Lined Pump

A centrifugal pump for handling abrasive materials that is said to obviate troubles arising from liner wear and to have an increased general efficiency is now being marketed by the Krogh Pump & Machine Works, San Francisco, Calif. This is a lined centrifugal pump, with hollow runner arranged for ample clearance between runner and side liners, which can be adjusted several times before replacement is necessary.

A special feature of this design, as shown in the acompanying cross-section, is the suction-pipe liner, which is engaged by threaded screws, passing through the casing and held by locknuts. When wear occurs at the impeller hub, these screws can be turned from the outside without stopping the pump and minimum clearance is restored. This permits the pump to be operated at maximum efficiency and output at all times, irrespective of the wear on the impeller hub and without raising the speed. A direct and unimpeded flow from the stationary suction pipe to the interior of the revolving runner is claimed for the pump, which is said to lack the churning effect and consequent loss of power observed in pumps with open suction runners.

Wearing parts are made of a special hard metal. The runner is threaded on the shaft and can be removed and replaced without disturbance of the shaft in its bearings. The bearings are of the ring-oiling type and the thrust is taken on a double-row ball bearing. This pump is put out for handling all classes of abrasive, non-corrosive pulps, for conveying liquids having large quantities of sand, slime or clay in suspension and for the elevation of crushed or shredded materials of all kinds.

Motor Operated Valves

Two new motor-operated valves are being marketed by the St. Louis Motor Valve Co., St. Louis, Mo., the electrical equipment being manufactured by the General Electric Co. In one, for refrigerating work, the control is of the thermostatic type and permits of maintaining a number of cooled rooms from a single compressor, the opening and closing of the valves being automatically controlled by the respective thermostats in each room. The mechanism and valve are in separate units. The valve is of the stop-cock type with flanged ends and packing around the stem. A compensating spring maintains even pressure between the stem and seat. The driving mechanism may be mounted on any type of valve and may, if desired, be used to provide a number of intermediate positions between the two extremes. Sizes are available as follows: ½, 1 and 1½ inch.

The other new valve is a pilot valve designed for the remote control of fire or similar hydraulic systems. It consists of a four-way cock suitable for water or other liquids at pressures up to 350 lb. A motor is mounted on the valve together with a double worm reduction gear and a limit switch control, and an "open-close" push button completes the equipment and permits of remote control. This valve uses a 1/25 hp. motor for either direct or alternating current.

Manufacturers' Latest Publications

Riehle Bros. Testing Machine Co., Philadelphia, Pa.—A booklet entitled "The Evolution of the Testing Machine."

Irving Iron Works Co., Long Island City, N. Y.—A folder on the "Vizabledg," a safety step of steel for factory stairs.

Crouse-Hinds Co., Syracuse, N. Y.—Folders Nos. 33 and 39.—The first of these folders describes floodlight projectors and the second describes condulets for grounding service wire and conduit system.

U. E. Hungerford Brass & Copper Co., New York, N. Y.—A folder announcing the opening of a new branch 312 North 2d St., St. Louis, Mo.

Lee B. Mettler Co., 406 S. Main St., Los Angeles, Calif.—A leaflet on the subject of converting coal fired boilers to gas.

Homestead Valve Mfg. Co., Homestead, Pa.—Catalog No. 33. A new general catalog of all types of valves made by this company.

The Bristol Co., Waterbury, Conn.—Catalog No. 1700—A catalog describing the various types of indicating and recording tachometers made by this company.

Crouse-Hinds Co., Syracuse, N. Y.—Bulletins Nos. 39 and 217—The first of these describes condulets for grounding service wire and conduit system, and the second describes traffic signal systems.

Brown Instrument Co., Philadelphia, Pa.—Catalog No. 15—A new and complete catalog of Brown pyrometers, describing all types and, in addition, such accessories as thermocouples, protecting tubes, switches, etc.

Foote Bros. Gear & Machine Co., 250 N. Curtis St., Chicago, Ill.—New general catalog describing and giving prices of spur and worm gear speed reducers, flexible couplings, sprockets and gears of all kinds, and including engineering data on geared transmissions.

Connersville Blower Co., Connersville, Ind.—Bulletin 21-B—A new bulletin describing Victor rotary positive blowers for pressure and vacuum in all uses.

Charles Cory & Son, Inc., 183 Varick St., New York, N. Y.—Bulletin No. 3A-29-A—A catalog of Cory-Kent clear view screens, as used in various industries for eliminating trouble from clouded vision due to spray or mist.

Standard Conveyor Co., North St. Paul, Minn.—Catalog No. 5—A pictorial catalog showing the use of all types of Standard conveyors in many industries, and including specifications and layout of an inclined, portable elevating conveyor.

Yale & Towne Mfg. Co., Stamford, Conn.—A folder describing the Model 20B ball bearing electric chain hoist.

Norton Co., Worcester, Mass.—A new booklet describing refractory cements for lining or repairing linings of furnaces.

Drying Systems, Inc., 11 S. Desplaines St., Chicago, Ill.—A folder describing the "Phoenix" automatic self-cleaning, constant effect air filter.

Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, E. C. 1, England—Bulletin No. 36—A pamphlet on the electro-magnetic heat treatment of alloy steels.

E. J. Lavino & Co., Philadelphia, Pa.—Booklet No. 8-11-A—A booklet describing the use of "Kromepatch-Neutragrog" bottoms in forge and heating furnaces.

Henry Disston & Sons, Inc., Philadelphia, Pa.—A new catalog of machine knives, describing several new types made with Disston A-1 steel, a new special alloy.

Hardinge Co., York, Pa.—A leaflet describing the various new bulletins which this company has issued describing their products.

Quigley Furnace Specialty Co., Inc., 26 Cortlandt St., New York, N. Y.—Bulletin A-117—A new booklet on the use of Quigley acid-proof cement.

New Departure Mfg. Co., Bristol, Conn.—Pamphlet No. 22—A folder describing the use of ball bearings in high speed motor cars.

Morehead Mfg. Co., Detroit, Mich.—Catalog No. 15—New general catalog of steam traps and other equipment for steam drainage and boiler feeding.

Chicago Steel & Wire Co., Chicago, Ill.—A new booklet entitled "The Effect of Surface Materials on Steel Welding Rods."

Ajax Electrothermic Corporation, Trenton, N. J.—A new folder on the Ajax-Northrup high frequency electric induction furnace.

Engberg's Electric & Mechanical Works, St. Joseph, Mich.—Bulletin No. 302-B—A new bulletin giving horsepower tables for vertical enclosed self-oiling engines.

Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—Catalog No. S-33—A bulletin entitled "Steam Economy" which gives examples of the manner in which flow meters have helped cut costs in various industries.

The Truscon Laboratories, Detroit, Mich.—A folder describing "Stonetex," a coating for concrete, stucco, brick or stone which protects from weather and corrosion.

The Patterson Foundry & Machine Co., East Liverpool, Ohio.—A folder showing machinery for washing and refining clays, ochres, natural pigments and chemicals, including equipment for the fine grinding of these materials.

The International Nickel Co., 67 Wall St., New York, N. Y.—Bulletin No. 3—A bulletin on the heat treatment and applications of nickel and nickel-chromium steels. Also, the Monel Metal and Nickel Buyers' Guide for April, 1926.

The B. F. Goodrich Rubber Co., Akron, Ohio.—A new general catalog of rubber goods for chemical plant use. This bulletin features equipment made by the new "Vulcalock" process.

Sangamo Electric Co., Springfield, Ill.—Bulletin No. 71—Instructions for the Model D-5 watthour meter.

De Laval Steam Turbine Co., Trenton, N. J. — Bulletin E-1080 — A bulletin on centrifugal pumps for irrigation service.

Hills-McCanna Co., 2025 Elston Ave., Chicago, Ill.—A new catalog of non-ferrous alloys and products made by this concern.

National Tank & Pipe Co., Portland, Ore.—A leaflet announcing that this company has become a subsidiary of the M. & M. Wood Working Co., and will remain at its old location in Portland, Ore.

Foxboro Company, Foxboro, Mass.—A folder describing Foxboro-Horn portable tachometers and also Foxboro stationary tachometers and tachographs.

Poole Engineering & Machine Co., Baltimore, Md.—Bulletin 107—A new bulletin describing the Poole flexible coupling.

General Electric Co., Schenectady, N. Y.—Three new bulletins as follows: GEA-6, a bulletin on 500 series squirrel cage motors; GEA-71, a bulletin on wound rotor induction motors, type MT and MQ, series 900; GEA-246, bulletin of general purpose synchronous motors, series 7,500.

The Dust Recovering and Conveying Co., Cleveland, Ohio.—Bulletin No. 514—A description of a pneumatic conveying system for unloading and conveying soda ash and sand in a soap manufacturing plant.

Steere Engineering Co., Detroit, Mich.—Several bulletins as follows: bulletin No. 293, on checker type doors, manholes and handholes, and quick opening doors; bulletin No. 300, a general descriptive bulletin on the Backrun Gas Process; bulletin No. 303, a pamphlet describing the Backrun Process patents; bulletin No. 306, a bulletion on the three way Backrun valve application; bulletin No. 298, a description of the blast system for Steere water gas machines.

Patents Issued May 11 to 25, 1926

Paper, Pulp and Sugar

Fourdrinier Paper-Making Machine. Harry Liebeck, Swarthmore, Pa., assignor, by mesne assignments, to Scott Paper Company.—1,583,981.

Paper-Making Machine. George Lamoureux, Worcester, Mass., assignor to Scott Paper Company.—1,586,204.

Paper-Making Machine. Alonzo Aldrich, Beloit, Wis.—1,584,344.

Machine for Working Paper Stock. George L. Bidwell, Riegelsville, Pa., assignor to The Warren Manufacturing Company, Riegelsville, N. J.—1,583,771.

Paper-Mill Pump. Alexander X. Kennedy, Tyrone, Pa., assignor to William A. Riddell, Frederick, Md.—1,583,978.

Method of and Apparatus for Finishing Paper. Alexander G. Gilman, Kalamazoo, Mich.—1,583,788.

Method and Apparatus for Producing Compound Paper. Edward H. Angier, Framingham, Mass.—1,584,755.

Art of Making Pulp for Paper. Bertrand S. Summers, Port Huron, Mich.—1,584,902.

Process of Treating Sugar-Beet Diffusion Juice. Harry S. Thatcher, Los Angeles, Calif., and Samuel E. Josi, Chicago, Ill., assignors to The Celite Company, Los Angeles, Calif.—1,586,486.

Rubber and Synthetic Plastics

Rubber-Vulcanization Accelerator. Winfield Scott, Akron, Ohio., assignor to The Rubber Service Laboratories Co., Akron, Ohio.—1,586,121.

Process for the Manufacture of Artificial Resins. August Regal, Brno, Czechoslovakia.—1,584,472.

Method and Means for Molding and Hardening Phenol-Aldehyde Condensation Products. Godfrey Macdona Hick and Naomi Gertrude Hick, Brentwood, England.—1,585,348.

Furfural-Acetone Resins and Method of Producing the Same. Linwood T. Richardson, Milwaukee, Wis., assignor to The Cutler-Hammer Mfg. Co., Milwaukee, Wis.—1,584,144.

Petroleum Refining

Apparatus for the Decomposition and Recombination of Hydrocarbons. Alexander Thomas Stuart and Guy Noverre Middleton, Toronto, Ontario, Canada, assignors, by mesne assignments, to Farley G. Clark.—1,584,048.

Process for Continuously Distilling and Cracking Hydrocarbon Oils. John W. Coast, Jr., Tulsa, Okla., assignor, by mesne assignments, to Doherty Research Company, New York, N. Y.—1,585,233.

Apparatus for Cracking Oils. Ralph C. Holmes, New York, N. Y., and Frederick T. Manley, Houston, Tex., assignors to The Texas Company, New York, N. Y.—1,583,973.

Process of Cracking or Otherwise Altering the Composition of Hydrocarbons. Auguste J. Paris, Jr., Bradford, Pa.—1,585,687.

Process of and Apparatus for Distilling Oils. Clive Morris Alexander, New York, N. Y.—1,585,224.

Manufacture of Light Hydrocarbons. Lazar Edeleanu, Berlin-Charlottenburg, Germany.—1,586,357.

Treatment of Oils and Hydrocarbons. John Strother Miller, Jr., Rahway, N. J., assignor to The Barber Asphalt Company, Philadelphia, Pa.—1,586,376.

Apparatus for Distilling Hydrocarbons. Milon J. Trumble, Los Angeles, Calif.—1,586,130.

Continuous Refluxing Still. Milon J. Trumble, Los Angeles, Calif.—1,586,133.

Gasoline-Recovery Apparatus. Harold B. Bernard, Tulsa, Okla., assignor to Sinclair Oil and Gas Company, Tulsa, Okla.—1,584,504.

Apparatus for Refining Oil. Milon J. Trumble, Los Angeles, Calif.—1,586,132.

Treating Lubricating Oils. Edward Goodrich Acheson, New York, N. Y.—1,584,588.

Process for the Conversion of Oils. Joseph H. Adams, Brooklyn, N. Y., assignor to The Texas Company, New York, N. Y.—1,585,355.

Method of Using Concentrated Decolorizing Clays for Refining Lubricating Oils. Alphonsus Jurrissen, Martinez, Calif., assignor to Simplex Refining Company, San Francisco, Calif.—1,585,922.

Process for Renovating and Clarifying Used Gasoline. William Allinson, Des Moines, Iowa.—1,585,456.

Method of Electrochemical Treatment of Unsaturated Hydrocarbon Compounds Resulting from the Cracking of Oils. Donald L. Thomas, New York, N. Y.—1,585,573.

Organic Processes

Process for Production of Lead Acetate. Rudolf Plaüeln, Offenbach-on-the-Main, Germany.—1,585,316.

Production of Esters from Amide Acid Sulphates. Ralf B. Trusler, Dormont, Pa., assignor to The Roessler & Hassiacher Chemical Company, New York, N. Y.—1,584,907.

Process of Making Acetylated Nitrocellulose. Harry P. Bassett, Cynthiana, Ky., and Thomas F. Banigan, Philadelphia, Pa., assignors to Meigs, Bassett & Slaughter, Inc., Philadelphia, Pa.—1,586,437.

Method of Purification and Isolation of Anthraquinone Beta Sulphonic Acid. Ivan Gubelmann and Robert J. Goodrich, South Milwaukee, Wis., assignors to The Newport Company, Carrollville, Wis.—1,584,372.

Process of Making Crotonaldehyde. Clarence J. Herrly, Niagara Falls, N. Y., assignor to Carbide and Carbon Chemicals Corporation.—1,585,096.

Oxygen Compound of Terpene and Process of Making Same. Alexander S. Ramage, Detroit, Mich., assignor to The Ozonid Corporation, Detroit, Mich.—1,585,602.

Method of Producing a Fertilizer of Urea. Johan Hjalmar Lidholm, Wargon, Sweden.—1,584,875.

Nitroglucoside Explosive. Robert C. Moran, Woodbury, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,583,895.

Process for the Production of Glucosides of Digitalis. Franz Rahn, Nieder-Ingelheim-on-the-Rhine, Germany, assignor to C. H. Boehringer Sohn, Nieder-Ingelheim-on-the-Rhine.—1,586,116.

Manufacture of Mononitrochloro Benzene. John W. Livingston, St. Louis, Mo., and Lucas P. Kyrides, Buffalo, N. Y.—1,586,253.

Diazotization of Organic Compounds. Clarence P. Harris, New York, N. Y., and Nathaniel M. Elias, New Brunswick, N. J.—1,585,145.

Barbituric Acid Derivative. Werner Ursum, Ludwig Schütz, and Ludwig Taub, Elberfeld, Germany, assignors, by mesne assignments, to Winthrop Chemical Company, Inc., New York, N. Y.—1,584,156.

Thionaphthisatins and the Process of Making Same. Hermann Staudinger, Zurich, Robert Stocker, Richard Tobler, and Armin Bucher, Basel, and Jakob Mueller, Munchenstein, near Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,586,013.

Process of Producing Hydrocyanic Acid. Robert W. Poindexter, Jr., Los Angeles, Calif., assignor, by mesne assignments, to California Cyanide Company, Incorporated.—1,584,137.

Art of Purifying and Deodorizing Isopropyl Alcohol. Matthew D. Mann, Jr., Rosselle, and Robert B. Lebo, Elizabeth, N. J., assignors to Seth B. Hunt, trustee. Mount Kisco, N. Y.—1,585,042.

Method of Manufacturing Artificial Silk and Other Products from Nitrocellulose. Emile Bindschedler, Landsdowne, Pa., and George Juer, Hopewell, Va., assignors to Tubize Artificial Silk Company of America.—1,584,005.

Process for Making a Highly-Active Charcoal in Grains. Hellmuth Müller-Clemm, Mannheim, and Erwin Schmidt, Mannheim-Waldhof, Germany, assignors to the Firm Gesellschaft für Chemische Produktion m. b. H., Mannheim-Waldhof, Germany.—1,586,106.

Artificial Tanning Substance. Otto Schmidt, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,583,801.

Manufacture of Starch. John M. Widmer, Cedar Rapids, Iowa, assignor to Penick & Ford, Ltd., Incorporated, Cedar Rapids, Iowa.—1,585,452.

Inorganic Processes

Separation of Hafnium and Zirconium. Dirk Coster, Haarlem, Netherlands, and Georg von Hevesy, Copenhagen, Denmark, assignors to N. V. Philips' Gloeilampenfabrieken, Eindhoven.—1,586,241.

Production of Refractory Oxide Ware. John Wesley Marden, East Orange, N. J., assignor to Westinghouse Lamp Company.—1,585,779.

Process of Making Sodium Sulphide. Harry P. Bassett, Cynthiana, Ky.—1,584,597.

Production of Phosphorus Products. Gustav Pistor, Griesheim-on-the-Main, and Ernest Borsbach, Bitterfeld, Germany, assignors to the Firm: Chemische Fabrik Griesheim Elektron, Griesheim-on-the-Main, Germany.—1,586,115.

Manufacturing Process for Cements Containing Iron and Alumina Combinations. Ernest Martin, Aix-en-Provence, France.—1,586,099.

Process of Producing Substances from Boron and Carbon. Emil Podszus, Berlin-Friedrichshagen, Germany.—1,585,412.

Method of Manufacturing Metal Powder. Genzo Shimadzu, Kyoto, Japan.—1,584,149.

Process of Manufacturing Powder of Lead Suboxide Intermingled with Powder of Metallic Lead. Genzo Shimadzu, Kyoto, Japan.—1,584,150.

Process of Treating Crude Cyanide. Rolfe E. Glover, Jr., and Thomas Hunton Rogers, Wilmington, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,586,509.

Powdered Sulphur and Method of Making the Same. William Hunter Volck, Watsonville, Calif., assignor to California Spray-Chemical Company, Watsonville, Calif.—1,585,058.

Preparation of Sodium. Paul Léon Hulin, Grenoble, France.—1,585,716.

Recovery of Thiocyanates. Marc Darrin, Wilkinsburg, Pa., assignor to The Koppers Company, Pittsburgh, Pa.—1,584,852.

Chemical Engineering Equipment and Processes

Crusher. Albert H. Stebbins, Los Angeles, Calif.—1,585,052.

Gyratory Crusher. Richard Bernhard, Allentown, Pa., assignor to Benjamin A. Mitchell, Tompkinsville, Staten Island, N. Y.—1,584,697.

Drier. Bradley Dewey, Cambridge, Mass., assignor to Dewey and Almy Chemical Company, Cambridge, Mass.—1,585,283.

Drying Mechanism and the Like. Samuel Gertz, Cleveland, Ohio, assignor to The C. O. Bartlett & Snow Company, Cleveland, Ohio.—1,584,764.

Apparatus for Calcining Crude Lithopone and Other Materials. August Sonnin Krebs, Wilmington, Del., assignor to Krebs Pigment & Chemical Company, Newport, Del.—1,584,381.

Kiln for Burning Earthenware. Wilson L. Burley, Crooksville, Ohio.—1,585,015.

Means for Burning Lime. John T. Mabee, Chicago, Ill., assignor to Raymond Bros. Engineering Co., Chicago, Ill.—1,586,318.

Tunnel Kiln. George W. Booth, New Toronto, Ontario, Canada.—1,585,013.

Tunnel Kiln. Paul A. Meehan and Harry M. Robertson, Cleveland, Ohio, assignors to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,584,883.

Method of and Apparatus for Liquefying Chlorine Gas. William M. Jewell, Chicago, Ill., assignor to Chlorine Products Company, Chicago, Ill.—1,584,376.

Apparatus for Handling Sludge Acids. David R. Henderson and Albert H. Hill, Arkansas City, Kans.; said Henderson assignor of his interest to Earl H. Sleeth, Arkansas City, Kans.—1,585,986.

Apparatus for the Manufacture of Superphosphate. Frederick William Rogers Williams, London, England.—1,585,810.

Ceramic and Refractory Making Process and Material. Anson G. Betts, Kinderhook, N. Y.—1,585,826.

Apparatus for Manufacturing Carbureted Water Gas. George Wallace Smith, San Antonio, Tex., and Frank L. Weisser, Miami, Fla.—1,585,429.

Apparatus for Making Plate Glass. William G. Watson, Ford City, Pa., assignor to Pittsburgh Plate Glass Company.—1,583,817.

Process and Apparatus for Making Sheet Glass. Karl L. W. Core, Ford City, Pa., assignor to Pittsburgh Plate Glass Company.—1,583,779.

Salt Glazing. Harry George Schurecht, Pittsburgh, Pa., assignor of one-half to Henry Thomas Shelley, trustee, Philadelphia, Pa., and one-half to George Casper Dooring Lenth, trustee, Chicago, Ill.—1,583,901.

Lime Treatment of Skins. Maurice Bourguignon, Paris, France, assignor to Societe du Feutre, Paris, France.—1,586,062.

Low-Temperature Explosion Process of Disintegrating Wood and the Like. William H. Mason, Laurel, Miss.—1,586,159.

Apparatus for Distillation of Car Bonaceous Substances. Edgar Rouse Sutcliffe, Leigh, England, assignor to Pure Coal Briquettes Limited, Cardiff, Wales.—1,584,487.

Apparatus for Making Sheet Glass: William Owen, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company.—1,583,793.

Process of Obtaining Oil and Casein from Cream. Charles E. North, Montclair, and Herbert B. Larner, East Orange, N. J., assignors to The Milk Oil Corporation, Wilmington, Del.—1,584,124.

Process of Emulsifying and Converting Fats Into Cream. Charles E. North Montclair, N. J., assignor to The Milk Oil Corporation, Wilmington, Del.—1,584,126.

News of the Industry

Fertilizer Convention Held at White Sulphur Springs

The new National Fertilizer Association closed the first year of operation on a strictly national basis with its convention at White Sulphur Springs, West Virginia, June 7 to 10. Interest in fundamentals and optimism for the future of the business were notable features of a well attended series of sessions. The week was enlivened by the contests for a constantly growing number of handsome trophies awarded in golf, tennis, and other tournaments. Addresses on technical and economic questions of fundamental importance to the industry were conspicuous while routine business and dull committee reports were notable for their absence.

George R. James of the Federal Reserve Board gave a masterly bit of sugar coated instruction on credit, a problem of hiring money not of borrowing. Elimination of waste by simplification through a reduced number of fertilizer formulas and the essentials of soil science as governing fertilizer economics were discussed respectfully by John J. Watson, president of International Agricultural Corporation and by Sidney B. Haskell, director of Massachusetts Agricultural Experiment Station, affording further evidence of consideration of economics as an aid to the business.

A full system of cost accounting for manufacturers of sulphuric acid and acid phosphate has been completed by a committee under the chairmanship of B. A. McKinney, of the F. S. Royster Guano Co., who reported that the printing of the final report is now under way. Technology in the chamber process for manufacture of sulphuric acid was reviewed by Dr. P. C. Hoffman of Virginia-Carolina Chemical Corporation who traced plant improvements through the 40 years of his experience in the industry. Yields have increased to 4.85 lb. of acid per lb. of sulphur, chamber space reduced from 30 to 8 or 10 cu.ft. per lb. of sulphur burned, nitre consumption notably reduced, and fuel use lowered to a quarter. Further progress is forecast in the lines of lowered plant investment rather than in further increases of operating efficiency. Harry A. Curtis of Yale University reviewed the world nitrogen situation, emphasizing trends to lower nitrogen prices with increasing supplies.

In a later issue of *Chem. & Met.* this report will be fully reviewed as will that by F. S. Lodge of Armour Fertilizer Works who spoke on "The Modern Fertilizer Factory," a paper on "Cost Accounting for Producers of Sulphuric Acid and Acid Phosphate" by B. A. McKinney and "The Development of Sulphuric Acid Manufacture in Its Relation to the Fertilizer Industry" by P. C. Hoffman.

Tariff Hearings on Phenolic Resin Importations

Voluminous testimony was taken by the Tariff Commission at hearings late in May and again beginning June 8 in connection with the complaint of the Bakelite Corporation and other domestic manufacturers that the patent and other rights of the Bakelite concern were being violated by importations of synthetic phenolic resin and articles made from it, principally from Czechoslovakia and Austria.

Complaint was made to the Commission in December and again in January, under Section 316 of the 1922 tariff act, which deals with unfair competition, and, acting on a preliminary report from the Commission, President Coolidge late in April issued a proclamation prohibiting the admission of such imports pending hearing of the case.

On petition of Lewis Levy, Jerome Gevirman, Gustave Levinstein and Richard Ganz, importers of New York, the Commission held a special hearing to receive protests against the embargo on May 17 and began its regular hearing in the case May 24, adjourning the following day until June 8 when the hearing was resumed.

Most of the testimony has revolved around cigar and cigarette holders, beads and umbrella handles made of the Form C snythetic phenolic resin. It is contended by the complainants that the imported articles are of inferior quality and sold at such low prices as to threaten the business of the domestic industry. The importers contend no patent rights are involved and that there are no unfair methods of competition.

Worcester Tech Offers Service To Industry

With the aim of extending its industrial services the Worcester Polytechnic Institute has announced to the industrial concerns of Worcester and Worcester Company its readiness to offer them assistance in the solution of their technical problems, and particularly to place its resources at the disposal of those concerns which do not maintain individual laboratories of their own.

Engineering Foundation Aids Research Projects

The quarterly meeting of the Engineering Foundation was held on May 19, members and guests gathering for dinner at the Union League Club, New York. Edward Dean Adams, engineer, financier, and scientist to whom the John Fritz Gold Medal had been presented last March, was present as guest of honor.

Financial assistance was granted to two research projects requested by the American Institute of Mining and Metallurgical Engineers and the American Institute of Electrical Engineers. The sum of $4,000 a year for four years was granted for research in blast furnace slags by Professor R. S. McCaffery, University of Wisconsin. The sum of $5,000 a year for two years was granted for research in electrical insulation by Professor J. B. Whitehead, Johns Hopkins University.

On behalf of the endowment committee W. L. Saunders announced that a contribution of $100,000 had been made to the Foundation by Edward Dean Adams. In response to an appropriate resolution Mr. Adams was elected a honorary member for life in recognition of the valuable service he had rendered as vice-chairman of the Engineering Foundation for the past ten years.

Addresses were made by Dr. John A. Mathews, president of the Crucible Steel Company of America, on "Present Tendencies in Engineering Materials" and by Professor Richard S. McCaffery on "Research in Iron Blast Furnace Slags." Dr. Mathews paid his respects to the present tendencies toward standardization in engineering materials through written specifications which are often practically useless. He deplored the necessity of "manufacturing down to a specification rather than up to an ideal." Unless specifications offer an advantage to both the maker and the buyer and contribute to public welfare they are often bars to progress. Dr. Mathews stated that metallurgy is rapidly becoming a branch of physical chemistry and cited alloy steels resistant to corrosion and high temperatures as examples of scientific efforts to meet engineering demands.

Professor McCaffery reviewed briefly the research in iron blast furnace slags in the University of Wisconsin and showed how their fundamental study of the constitution of slags was finding useful application in blast furnace operation. These studies will be continued under the support of the Engineering Foundation.

Dominion Chemists Convene in Montreal

W. Lash Miller to Head Canadian Institute of Chemists

The ninth annual Dominion Convention of Chemists under the auspices of the Society of Chemical Industry, the Technical Section of the Pulp and Paper Association, and the Canadian Institute of Chemistry, was held in Montreal from May 31 to June 3 inclusive and was attended by more than 200 chemists from Canada and the United States. Staffs of the departments of chemistry of practically every university in Canada as well as many institutions in the United States sent representatives. In addition, there were present a large and important representation of chemistry in industry.

In his annual address as vice president and chairman for Canada of the Society of Chemical Industry, Dr. A. E. Macintyre emphasized the importance and standing today of chemistry, being greater now than at any time in its history. He added: "The majority of the industrialists and the general public have little conception of the nature and extent of the great technical developments of the past few years.

Prof. R. Harcourt, of the Agricultural College of Guelph, Ont., in his annual address as retiring president said that progress as a national body was being made by the Canadian Institute of Chemistry. "Under it," he said, "chemists in Canada have classified themselves into two grades, or even three, considering those below Institute standards as third. This is more than the medical, dental or legal professions have dared to do, and yet everyone knows that doctors, dentists and lawyers are not all equally proficient."

Nitrocellulose lacquers and their use as protective coating was the topic of an address by Arthur Orr, of the Commercial Solvents Corp., Terre Haute, Ind. Mr. Orr stated that the process was first used at Toronto during the war days, when the British Government produced acetone, the product that was so necessary in the manufacture of cordite. In the course of further experiments, the uses of butanol, formerly regarded as useless, have been realized, and it is largely due to butanol that the lacquer industry is so lively today.

R. E. Gilmore, superintendent of fuel testing laboratories, Federal Department of Mines, read a paper on Gasoline and Substitute Motor Fuels, With Special Reference to Synthetic Methanol and Synthol," in which he maintained that the consumption of gasoline in all parts of the world has become, and will become so great that it is merely a question of time when the world's natural gasoline supply will be exhausted.

In his statistical survey of chemical production in Canada in 1925, S. J. Cook, chief of the mining and chemical branch of the Dominion Bureau of Statistics, pointed out that one-fifth, or $600,000,000 of the aggregate value of Canadian manufactures each year is contributed by chemical processes.

Dr. W. Lash Miller, of Toronto, was chosen head of the Canadian Institute of Chemistry for the 1926-27 term. Other officers elected were: secretary, Prof. J. B. Ferguson, Toronto; new members of the council, Prof. M. A. Parke of Winnipeg; Prof. A. L. Kelsall of Annapolis Royal College, Nova Scotia; Dr. R. M. MacLean, Montreal; Dr. R. T. Elworthy, Ottawa, and Dr. A. Bruce Macallum, London, Ont.

Henry Howard Elected President of Manufacturing Chemists

The Manufacturing Chemists' Association held its annual meeting, June 2, at the Whitehall Club, New York. The executive committee submitted an exhaustive report which stated that the record of the last year was one of

Henry Howard

definite accomplishment with satisfactory progress in newer activities that have been taken up by the association. The report stressed the importance to the chemical industry of work that had been done by the association on matters relating to traffic and transportation. Henry Howard of the Grasselli Chemical Co. was elected as president of the association for the coming year. Other officers elected were: W. D. Huntington, Davison Chemical Co., and H. A. Galt, Columbia Chemical Division of the Pittsburgh Plate Glass Co., vice-presidents; Salmon W. Wilder, the Merrimac Chemical Co., treasurer; John I. Tierney, Washington, D. C., secretary.

Member of the executive committee will include: Chairman, Adolph G. Rosengarten, Powers-Weightman-Rosengarten Co; Dr. Charles L. Reese, E. I. du Pont de Nemours & Co.; Wm. H. Bower, Henry Bower Chemical Mfg. Co.; C. W. Millard, General Chemical Co.; H. F. Atherton, National Aniline & Chemical Co.; H. L. Derby, The Kalbfleisch Corporation; Phillip Schleussner, Roessler & Hasslacher Chemical Co.

Addresses were made by B. W. Dunn, chief inspector for the Bureau of Explosives of the American Railway Association; C. C. Concannon, chief of the chemical division, Bureau of Foreign and Domestic Commerce; and A. E. Foote, of the division of simplified practice of the Department of Commerce.

German Company Erects New Phosphorus Plant

European rights for the Liljenroth phosphorus-hydrogen process have recently been sold to the Badische Anilin- und Soda Fabrik, and this company is now erecting a large (60,000 kw.) phosphorus plant at Pistoritz on the river Elbe using "brauncoal" power. The phosphorus will be transported in tank cars to the Leuna ammonia plant of the Badische company where it will be converted by the Liljenroth process into phosphoric acid and hydrogen. The hydrogen will be utilized in the existing ammonia plant, the capacity of which is sufficiently large to take care of this extra supply of hydrogen without any additional investment. The phosphoric acid will be converted with ammonia into diammonium phosphate containing about 52 per cent P_2O_5 and 25 per cent NH_3. It is interesting to note that diammonium phosphate contains the same amount of ammonia as ammonium sulphate and in addition thereto not less than 52 per cent P_2O_5. The bagging and transportation of this phosphoric acid is, therefore, a direct saving. In addition there is also an important saving of sulphuric acid. The advantages of cheap byproduct hydrogen and concentrated and pure phosphoric acid are the attractive features of the process. The diammonium phosphate produced has been found to be a stable compound with excellent physical and fertilizing properties.

Patent Office Committee Makes Full Report

A new modern building suitably constructed and equipped, increased technical force with adequate salaries and amendment of existing Patent law to facilitate the handling of appeals are among the outstanding needs of the United States Patent Office if it is to render the timely service that American business demands, Secretary Hoover has been advised by the Special Patent Office Committee. The Committee originally appointed by Secretary Work of the Interior Department in July, 1924, was enlarged by the addition of two engineers at the time the Patent Office was transferred to the Commerce Department in April, 1925. After making a preliminary statement of Secretary Work in February, 1925, the Committee has completed its full report which goes into all phases of Patent Office activity, containing one hundred and eight separate recommendations.

Duties On Magnesite Will Be Discussed June 21

Questions involved in the proposed increase in the rates of duties on crude magnesite and caustic calcined magnesite will be considered at a public hearing before the U. S. Tariff Commission June 21. The application for the increase in duty comes from the Sierra Magnesite Co., of Chicago, and C. S. Maltby of San Francisco, under the flexible provisions of the Tariff Act which would make it possible to increase the duty 50 per cent.

News from Washington

By Paul Wooton
WASHINGTON CORRESPONDENT OF *Chem. & Met.*

WITHOUT boasting, the United States now can lay claim to a greater chemical industry than that possessed by any other country. The infant industry of a few short years ago has outgrown its German and British competitors.

In one sense, however, the American chemical industry is underdeveloped. Only 7 per cent of its production is exported. If the same proportion of the American output were exported as is the case in Germany, our foreign trade would total $600,000,000 instead of $150,000,000. Information reaching Washington indicates that there is a distinct demand within the industry to develop the export end of the business.

Some think the best way to stimulate interest in foreign markets would be to have a great gathering in Washington of chemical executives. The chemical division of the Department of Commerce has exact data showing all details of the world market. It has a wealth of data on the methods used so successfully by the British, Germans and Swiss in annexing most of the world trade. There are many men in the industry who are unselfish enough to be willing to allow the whole industry to take advantage of the lessons of their experience.

Such a meeting has been under discussion for a year. The idea seems to be popular and a definite call for such a gathering is likely to be forthcoming before long. The though behind making the meeting one of executives is that if those in attendance are convinced that more attention should be given foreign trade, they will have the authority to put an active program into effect. There is a feeling that gatherings within the chemical industry are attended by engineers and research men in larger proportion than those concerned with the active management of the business. Too frequently when the technical man returns from a gathering of chemists with ideas pertaining to the business policy his conclusions are not given weight, even when great respect is entertained for his deductions from the scientific information presented.

The hope is expressed that the industry will prepare to contend for a larger portion of the world trade before it is forced to do so. Expansion is going forward rapidly. When the biennial census for 1925 is issued it is expected to show a great development over 1923. Production in many lines is known to be expanding more rapidly than domestic consumption. If there is not to be over-production and overcapacity on a halting of expansion, foreign markets must be developed. Of the alternatives it is believed that the halting of expansion is the more likely to result as statistics — the great stabilizer of business—have been developed to the point where ample warning will be given against the production of goods faster than they can be absorbed. Incidentally one object of the proposed chemical day will be to strengthen the industry's statistical services. Should there be monthly figures on such commodities as sulphuric acid and caustic soda? For commodities produced in less quantities would quarterly figure suffice? Should there be a census of distribution so that information can be available as to stocks? Such questions as these would be discussed at the meeting.

Because of the diversified character of the chemical industry there is great need for the working out of such common ground as exists. This would be one of the main purposes of the meeting.

Chemical Advisory Committee

Principal discussion at the meeting of the Chemical Advisory Committee to the Department of Commerce, on the occasion of a meeting of the committee in Washington June 7, seems to have revolved around The Hague Patent Protocol and the extension of statistical services. The meeting of the committee was executive and no information was forthcoming as to the discussions, except a prepared statement, which reads as follows:

"The Chemical Advisory Committee to the Department of Commerce met at the Department in Washington yesterday and the following members of the committee attended: A. Cressey Morrison, New York City, chairman of the committee; H. E. Howe, Washington, D. C., secretary; Dr. A. S. Burdick, Chicago; Henry Howard, Cleveland; Dr. Leo H. Baekeland, New York City; Dr. Charles H. Herty, New York City; E. T. Twigg, Philadelphia. Messrs. G. Ober, Jr., of Baltimore, and S. W. Wilder, of Boston, were unable to attend.

"Mr. Hoover addressed the committee on matters of general interest affecting commerce and industry. Dr. Julius Klein, Director of the Bureau of Foreign and Domestic Commerce, conferred with the committee concerning the future development of the Chemical Division of the Department.

"C. C. Concannon, Chief of the Chemical Division, assisted by T. W. Delahanty, Assistant Chief, explained what progress had been made during the past year in perfecting and developing statistics pertaining to the chemical industry and outlined the new statistical services which are expected to be in effect shortly.

"It was announced that world surveys covering paints and varnishes and pyroxylin plastics were now under way and that the interpretation of these studies would be ready for dissemination within the next few months. Similar studies covering crude drugs, essential oils, serums and vaccines are contemplated and will be undertaken as soon as possible.

"The Chemical Division has been preparing an exhibit for the Sesqui-Centennial at Philadelphia, which will indicate the activities of the Division and the position which the United States occupies in the chemical industry of the world. Such charts, diagrams, and other exhibits as are now ready were presented and explained to the committee.

"The committee adjourned after having expressed the feeling that considerable progress has been made during the past year by the chemical industry of this country."

Since the meeting of the Advisory Committee a year ago the Chemical Division has expanded its import statistical service so as to include the synthetic organic chemicals of non-coal tar origin. At first only the imports of coal tar products were compiled. It is thought the Advisory Committee has recommended the extension of this service to all chemicals. It is assumed that the committee renewed its recommendation of a year ago that the personnel of the division be increased. It is doubtful if any increased service can be rendered without additional help.

A War Department announcement calls attention to a 9.5 per cent decrease in shipments of nitrate of soda through the Panama Canal for European destinations during the first ten months of the fiscal year. Significance is attached to the decrease in the amount of Chile nitrate going to Europe, in that it provides evidence that the days of at least one of the great government-aided monopolies are numbered.

Because of its military importance practically all countries, the small ones as well as the large ones, are doing what they can to establish a synthetic nitrogen industry. The aggregate of this production added to that of Germany is being felt more and more.

Increased shipments of the Chilean product to the United States have offset somewhat the loss to other countries, but there is no expectation that the market here will continue to expand. The uncertainty as to nitrogen production at Muscle Shoals is credited with having been the chief reason for the United States being so near the foot of the list in the matter of nitrogen production. That uncertainty may be removed any day and, at most, hardly can be held in abeyance longer than the December session of Congress.

With the adoption by the Senate of a resolution asking the Tariff Commission to investigate agricultural costs of producing cottonseed, peanuts and soya-beans, here and abroad, while the Commission was engaged in a heated public hearing on its preliminary statement of information regarding costs of producing the oils from these products and from coconuts, it is believed a report to the President in the vegetable oils case faces indefinite delay.

The Commission, however, has not formally decided whether to report the results of its vegetable oils investigation, which is the result of applications for reductions in duties, as soon as it can prepare a report, or to await the conclusion of its agricultural cost inquiry ordered by the Senate and submit the two jointly.

Demand for Salt Cake Declines Among French Consuming Trades

Glass Makers Preference for Sodium Carbonate Also Has Adversely Affected Production of Muriatic Acid

From our Paris Correspondent

MURIATIC acid is becoming scarce on the French market which explains the recent rise in prices asked for this product. This scarcity is due to the fact that our glass manufacturers, for technical reasons, are now using sodium carbonate in place of sodium sulphate. Muriatic acid always has been considered in France as a byproduct of sodium sulphate manufacture. Salt cake being in diminished demand, it follows that producing plants have limited their output and thus cut down the acid supply.

The production of muriatic acid, at 20 deg. Bé, is estimated at 150,000 tons per year. Two processes are chiefly employed; either common salt is treated with sulphuric acid, or the Hargreaves process is used, in which common salt, with a copper-salt as catalyzer heated to 500 deg. C., is submitted in the presence of air, to the action of sulphurous acid.

As regards electrolytic chlorine, interesting developments occurred during the war years. Production increased until it reached 15,000 tons per year or one-half of the German pre-war production. After the war most of these plants were closed and production fell to a point where it was not sufficient to satisfy home requirements. In turn the limited supply of chlorine adversely affected production of carbon tetrachloride and large amounts of the latter were imported.

Influenced by these conditions Kuhlmann is setting up a plant for the manufacture of electrolytic chlorine at his works at Loos near Lille. The Saint Gobain concern also is equipping its plant at Wasquehal for the same purpose.

In connection with the synthesis of hydrochloric acid starting from chlorine, it is interesting to note the process employed by the Bonelli company. Chlorine and water are passed through incandescent coal. The coal burns without difficulty in an atmosphere of steam and chlorine while hydrochloric acid, carbon monoxide and dioxide are produced.

Let us add that French production of sodium sulphate has averaged about 150,000 tons per year of which about 30,000 tons were exported.

Interesting attempts have been made to establish the carbonization of seaweed in closed vessels which gives a yield higher than that obtained by the processes formerly used. With the new process 10 kg. of iodine can be obtained from 1 ton of sea-weed ashes corresponding to 5 tons of dried sea-weed and to 25 tons of fresh sea-weed.

The improvements realized can be gaged by the following figures: In 1905, 1,200,000 tons of fresh sea-weed was gathered in Europe with a yield of 240 tons of iodine. With the new process the latter figure could have been doubled. Brittany produced in 1914, 7,200 tons of ashes which gave 72 tons of iodine; in 1925 this production fell to 5,000 tons of ashes giving 50 tons of iodine. A company was formed in August 1925 under the name of "Société des Produits Chimiques marins" for the purpose of using the process of Charuau-Mourgeon in the treatment of sea-weed. Its capital is 1,400,000 francs which may shortly be increased to 3 million francs. The Société Alsacienne de Produits Chimiques has also recently formed a branch to recover iodine from sea-weed by improved processes.

The "Journal Officiel" of April 29, publishes two decrees compelling two new gas plants to complete within two years the debenzolizing of their whole gas production. These two works are the gas plant of Le Havre belonging to the European Gas Co., which is an English concern having its main office in London and the gas plant of Reims which belongs to the Compagnie du Gaz et de l'Electricité.

A new French industry which is reaching a real commercial basis is that of the extraction of oil from grape seeds. Apparatus has been built for the sorting of the seeds. The difficulty, which lay in the acidity of the oil from these seeds, has been overcome. This acidity which can reach 24 per cent of oleic acid, is due to a mould which develops on the wet seeds when they have been shelled. This can be prevented by drying as soon as the shelling operation has been completed or by treating the seeds directly with trichlorethylene immediately after they have been taken out of the stills. By these means the acidity of the oil can be reduced to 2 per cent of oleic acid.

Grape seed oil has many properties in common with castor oil so that to a certain extent the use of these oils is interchangeable. As France imports large amounts of castor oil the commercial development of grape seed oil is regarded as important. Already there are four French plants engaged in crushing 10,000 tons of residuum of pressed grapes each season. New plants are in erection at Boufarik and Oran (Algeria) and at Aix, Clermont-l'Hérault. Such plants work under favorable conditions as soon as they have enough material i.e. 1,000 to 2,000 tons of residuum to treat every season. One thousand kg. of residuum yields about 230 kg. of grapestones of which 27 to 28 kg. of oil can be extracted. The residue gives an excellent oil-cake utilized as fertilizer.

Recently the society "La Mécanique Lyonnaise" has launched a new motor fuel with acetylene as a base under the name "Le Gaulois." Tests have been made at the autodrome of Montlhéry near Paris. These tests conducted by an official committee of the French Automobile Club have proved satisfactory although it is too early to predict the ultimate value of the fuel. The process consists in supplying the motors with two kinds of fuel: 1, with a gaseous fuel which is principally acetylene; 2, with a liquid fuel called diluting oil which is composed of 65 per cent of benzol, 25 per cent of gas oil and 10 per cent of white spirit.

Color Laboratory Engaged in Important Investigations

Important investigations under way at the Color Laboratory include the study of the possibility of producing vat dyes from phthalic anhydride and naphthalene, and alizarine from phthalic anhydride and o-dichlor-benzol. The previous work on the hydrolysis of the sulphonation products of naphthalene is being brought to a close, in order to devote more time to the study of the industrial utilization of the high-boiling coal-tar acids for which no commercial use has yet been found. A study of the properties and possible uses of lignin has been going forward for some time at the Laboratory. Important work is also being done in co-operation with the Commission on the Standardization of Biological Stains, both in the study of the old standard stains and in the development of new products.

As a résult of the recent large-scale commercial production of corn sugar, the Color Laboratory of the Bureau of Chemistry has initiated an investigation of the possibilities of using this dextrose as an industrial raw material. The new product is not only pure but is comparatively cheap and is available in almost unlimited quantities. An investigation has been started with a view to studying the products obtained by the fermentation of solutions of dextrose with molds, yeasts and bacteria, along lines not hitherto tried on a commercial scale.

The work of the Color Laboratory which is carried on both in Washington and at the experimental plant in Arlington, Va., is under the supervision of H. T. Herrick, chemist in charge.

Patent Legislation Pending in Congress

The following bills have been introduced in the Senate and House during the current session of Congress. While it is considered doubtful whether any of them will be acted upon at this session, all who are interested in the Patent Office and patent procedure are advised to acquaint themselves with the bills. Space does not permit giving more than the merest outline of the proposals:

S.2545, H. R. 9217, H. R. 12,368, amending the statutes as to procedure in the Patent Office and in the courts with regard to the granting of letters patent and with regard to interfering patents.

S.3745, providing for a 7-year extension of the time limitation on patents issued to persons who served in the armed forces of the United States during the World War.

H. R. 6249, relating to copyright registration of designs.

H. R. 8379, amending the patent laws.

H. R. 9277, changing the procedure in the Patent Office with regard to granting patents for inventions and designs.

Lacquer and Rayon Topics at Madison Meeting

Paint, Varnish, and Cellulose Chemists in Three-Day Convention

Lacquer and rayon were the centers of interest in the 3-day sessions of the paint and varnish and cellulose chemists, held in connection with the Mid-West Regional Meeting of the A.C.S. at Madison, Wis., May 27, 28 and 29. More than a hundred technical men participated in the live discussion of the problems that confront the manufacturer and user of paint and varnish materials. The meetings of the division of cellulose chemistry, which were given over to papers on nitrocellulose, cuprammonium cellulose and viscose solutions, proved equally attractive to representatives from the newer rayon industry.

Prof. W. T. Pearce, secretary of the paint and varnish section, was chairman of the first symposium on the durability of paints. Three papers dealing with exposure testing outlined detailed methods used by the North Dakota Agricultural College, the Forest Products Laboratory, and the New Jersey Zinc Co. at Palmerton, Pa. J. H. Calbeck, research director of the Eagle Picher Lead Co. of Joplin, Mo., showed the application of a statistical method to the results of published tests on durability. His study indicated that: (1) A high volume ratio of solids to binder in a paint aids in durability; (2) in paint containing mixtures of zinc oxide, white lead and inert, the durability increased as the percentage of zinc oxide decreased and as the percentage of white lead increased. The variation in percentage of inert had little or no influence; (3) initial chalking is no criterion of durability.

Accelerated testing came in for consideration in papers by H. A. Nelson and F. C. Schmutz of the New Jersey Zinc Co. P. R. Croll and S. N. Rhue of the Pittsburgh Plate Glass Co., C. D. Holley of the Acme White Lead & Color Works and F. W. Hopkins of the Murphy Varnish Co. These reviewed the latest improvements including many ingenious exposure devices that have proved effective in causing destruction of paint and lacquer films under controlled, but greatly accelerated conditions. A number of general papers also described advances in testing methods and operating practice.

The feature of maximum interest was the symposium on lacquers and the several general papers addressed to that subject. Bruce K. Brown of the Commercial Solvents Corporation in discussing brush lacquer formulation, pointed out that three methods of reducing the attack on undercoats were avaliable: (1) Heavy pigmentation, (2) use of relatively volatile solvents and (3) the development of solvent mixtures of minimum action. The last procedure offers greatest possibilities. W. A. McKim of Johnson, McKim & Johnson, reported on certain important physical properties of lacquers. His most important conclusions were: (1) Lacquers are little affected by humidity changes, but are greatly influenced by temperature changes; (2) gums increase the sensitivity to moisture; (3) balsams tend to make lacquers brittle; (4) the plasticizers used showed marked differences in effectiveness and permanency, the following being the order of increasing plasticizing action: triphenyl phosphate, triacetin, butyl tartrate, butyl phthalate, ethyl phthalate. All measurements were made with lacquers containing castor oil in addition to the plasticizer.

B. J. Oakes of Valentine & Co., F. W. Hopkins of the Murphy Varnish Co., and R. M. Carter of the U. S. Industrial Alcohol Co. discussed phases of lacquer analysis. Paul R. Croll, research director of the Pittsburgh Plate Glass Co., outlined a method for resin determination, for which few reliable tests are now available, particularly in lacquers where the presence of plasticizers causes complications.

At the well attended sessions of the Division of Cellulose Chemistry, papers from the laboratories of the Eastman and duPont companies dealt with cellulose in rayon and lacquer applications. W. O. Mitscherling of the Max Ams Chemical Engineering Corporation described certain characteristic properties of viscose and outlined procedure in the layout of a plant.

Use of Crucible Furnaces in Metal Melting

Some months ago *Chem. & Met.* published an item by its Washington correspondent relating to a questionnaire used by the Tariff Commission to determine the amount of graphite used for different purposes. The statement was made that in the non-ferrous metal industries the electric furnace had practically superseded the graphite crucible furnace. Crucible manufacturers have taken exception to this broad assertion and have submitted some information showing the present condition of the plumbago crucible manufacturing industry.

An old-established foundry directory lists about 2,000 non-ferrous foundries in the United States which report having in use approximately 8,300 crucible furnaces, and 1,400 non-crucible furnaces. The census figures show about 3,300 non-ferrous foundries in the United States; and assuming the same ratio it would indicate a total in use of about 13,600 crucible furnaces and 2,300 non-crucible furnaces.

Reports of sales of crucibles for use in non-ferrous foundries and brass rolling mills prepared by the principal crucible manufacturers of the country and based on the prosperous figures of 1919 as representing 100 per cent, show that sales for the six-year period from 1920 to 1925 inclusive have averaged 96½ per cent, this including the extremely bad year of 1921 when industry as a whole averaged only from 45 to 50 per cent of 1919 figures.

Emphasis is also placed on the fact that improvements in the manufacture of crucibles during the past decade have been such that records and reports indicate the average life of plumbago crucibles has been doubled during that period. Manufacturers therefore regard it as a reasonable assumption that today there is being melted in plumbago crucibles almost twice the amount of metal so melted in 1919.

Chemical Safety Conference at Niagara Falls

The Chemical Safety Conference met at the Niagara Hotel, Niagara Falls, N. Y., on May 21-22, under the auspices of the Chemical Section of the National Safety Council in conjunction with the Western New York Section, American Chemical Society; the Niagara Falls Division, American Electrochemical Society; the Niagara Falls Academy of Medicine and the Industrial Relations Group of the Niagara Falls Chamber of Commerce.

D. H. Kelly, president of the local chamber of commerce opened the conference on Friday morning with an address of welcome. Hon. James A. Hamilton, Industrial Commissioner of New York State, followed with an address on accidents in the chemical industry of New York State. Mr. Hamilton presented statistics which showed the relative standing of the chemical industries of the State in the matter of reportable accidents both as to severity and frequency of occurrence. Hazards in spray painting were described by Dr. H. F. Smyth of the University of Pennsylvania. Dr. Smyth presented an informal report on recent field work done by a sub-committee of which he is the chairman.

At the Friday afternoon session, a paper prepared by Dr. Lanza of the Metropolitan Life Insurance Co., on construction and maintenance of sanitary facilities in chemical plants was read by C. F. Carstens, safety engineer of the same company. Dr. Leonard Greenburg of the U. S. Public Health Service and Yale Medical School presented an informal report upon the investigation of benzol poisoning which has been conducted during the last 3 years by the National Safety Council. The final report of this Benzol Committee will be presented at the National Safety Congress which will hold a meeting at Detroit in October this year.

S. H. Kershaw, safety engineer for the National Safety Council, gave an interesting presentation of chemical plant accident prevention, in which he depicted with crayon drawings numerous safety devices for use in chemical plants. Mr. Kershaw's talk was discussed by G. C. Minshull, safety engineer for the du Pont Rayon Co., Buffalo, N. Y. On Friday evening J. T. MacBain, superintendent of the Union Carbide Co., gave a very interesting address at the same session on "Why do we try to prevent industrial accidents?"

At the Saturday morning session the subject of Silicosis and the general effect of dust upon the lungs was ably discussed by Dr. P. H. Hourigan of the Larkin Co., Buffalo. The closing topic of the conference was co-operation of the foreman, chemist and superintendent with the physician. Dr. F. J. Lennon of Buffalo read the main paper and general discussion followed, led by E. A. McManus of the Hewitt Rubber Co., speaking from the superintendent's viewpoint, R. H. Pestelle of the du Pont Rayon Co., from the chemist's viewpoint, and Bertram Stiles of the Pierce Arrow Motor Car Co. gave the views on this question as they appeal to the foreman.

National Lime Association in Annual Convention

The Eighth Annual Convention and the twenty-fourth annual meeting of lime manufacturers held at French Lick, Indiana, June 8-11, combined technical and popular discussions of problems of interest to manufacturers and users of lime with general good fellowship and get togethers. The first three days were devoted to business meetings and the fourth was a field day given over to competitive sports.

Two speakers from outside the industry presented interesting discussions. Irving Fellner, sales manager of *Chem. and Met.*, presented a detailed analysis of lime markets and outlined the directions in which promotion and sales efforts should be most productive. J. P. Mollenkof, superintendent of construction for John H. McClatchy of Philadelphia, pointed out the advantages and economies in the use of lime as a structural material and illustrated these points by numerous data and photographs obtained on the actual operations of his company where 600 to 800 homes are built annually.

One full day was devoted to presentations of the activities of the various departments of the association headquarters organization by the department directors. R. P. Brown discussed the work of his publicity department under the caption of "Balanced Publicity" and pointed out the principles underlying the preparation of various types of literature including scientific, technical, popular and sales, and stressed the importance of the literature of member companies as supplementing the Association activities.

J. S. Elwell, manager of the Construction Department, illustrated by means of films the various uses of lime in construction. These films and the projecting machine are available for use at meetings of architects, contractors, dealers, salesmen, students, etc. The uses of lime in concrete and asphalt highway surfacing and in the treatment of earth roads were described by C. R. Stokes, manager of the Highway Department, and H. W. Wood of the same department.

The opportunities for lime in industrial fields were covered by L. B. Burt, manager of the Industrial Department, special emphasis being directed toward the growing utilization of lime in the treatment of industrial wastes such as mine waters and creamery, cannery, steel mill and tannery effluents. The practical aspects of research were discussed by G. J. Fink, chemical director, who pointed out the relation of the Research Department and the services offered the other departments and stressed the fact that the success of promotion and sales efforts depends upon the co-ordination of business principles with the results of research. Opportunities for research to contribute valuable data obtained by investigations and by comparisons of costs were emphasized and it was pointed out that a research department must always be in a position to answer two questions, namely, "Will it work?" and "Will it pay?" The publicity value of a research unit of recognized standing was also discussed.

Almost all those in attendance at the Convention participated in the two round-table conferences, the first of which was devoted to problems relating to manufacture and the second to properties and uses. Discussions presented included the following: "Recent Improvements in Calcining and Hydrating Equipment," J. C. Schaffer; "Flow of Heat Through Limestone," R. T. Haslam; "A Continuous Shaft Kiln for Burning Fine Stone," H. Miscampbell; "Heat Distribution in Lime Kilns and Evolution of the 'Ultimos,'" V. J. Azbe; "Lime in Treatment of Sewage and Industrial Wastes," J. R. Withrow; "Reburning of Lime Sludges," D. E. Washburn; "Lime for Gas Absorption and Scrubbing," R. T. Haslam.

Penn. State Creates Division of Industrial Research

Dr. Wheeler P. Davey, for 12 years a member of the research laboratory of the General Electric Co., Schenectady, N. Y., has resigned to accept the professorship of physical chemistry at the Pennsylvania State College.

Dr. Davey will also hold a professorship in the newly organized Division of Industrial Research which is extending research service to the industries. Dr. Gerald Wendt, Dean of the School of Chemistry and Physics, is Director of this division and an advisory committee has just been appointed which consists of A. N. Diehl vice-president of the Carnegie Steel Co.; Col. Wm. H. Walker, formerly head of the department of chemical engineering at the Massachusetts Institute of Technology; Dr. E. R. Weidlein, Director of the Mellon Institute; G. M. Norman, Technical Director of the Hercules Powder Co.; W. H. Teas, president of the Marion Extract Co.; Dr. H. S. Miner, Technical Director of the Welsbach Co., and Dr. F. G. Breyer, Chief of the Research Division, New Jersey Zinc Co.

Dr. Wheeler P. Davey

Dr. E. D. Ries, now instructor in the department of chemical engineering at the Massachusetts Institute of Technology, has been appointed associate professor of chemical engineering in the same program of development. Dr. Eugene Lorand, formerly technical adviser to the Anglo-Hungarian Bank at Budapest, Hungary, has been appointed assistant professor of industrial research.

News in Brief

Petroleum Statistics To Be Given in Barrel Units—The Bureau of Mines, has arranged for an immediate change in the unit measurements for statistics in the petroleum industry dealing with refined products, using the barrel unit of 42 U. S. gals. instead of the gallon unit. A canvass in the industry regarding the change resulted in a majority of about 4 to 1 in favor of quotations in barrel units.

Soda Pulp Mill Going Up at Cornwall, Ontario—The Canadian Cellulose Co., a subsidiary of the Howard Smith Paper Mills, of Montreal, has commenced the erection of a soda mill at Cornwall, Ontario. The new mill will enter production by the spring of 1927 at the latest and will, at that time, have an annual capacity of from 12,000 to 15,000 tons of soda pulp.

Chemists Club Offers Two Scholarships—The two scholarships open to students in industrial chemistry and chemical engineering, which are awarded each year by the Chemists' Club of New York City, are now available to applicants according to a recent announcement made by the Club's Scholarship Committee. One is the Bloede scholarship, founded by Dr. Victor G. Bloede of Baltimore, and amounts to $500. The other with an income of $400 was endowed by William H. Hoffmann of Newark, N. J. The competition is not limited geographically, and the winner may carry on his work at any university in the country providing it has the approval of the Club's Scholarship Committee.

Du Ponts Form New Ammonia Company— The Du Pont National Ammonia Co. with a capital stock of $13,100,000 has been organized under the laws of Delaware. This is a holding corporation for the interests of E. I. du Pont de Nemours & Co. and the National Ammonia Co., Inc., in the manufacture of ammonia from nitrogen of the air through the Claude process and for the sale of the product. The new holding corporation has had transferred to it the major part of the stock holdings of E. I. du Pont de Nemours & Company in Lazote, Inc.

German Dye Trust Declares Dividend—At a meeting of the administrative council of the I. G. Farbenindustrie A. G. Frankfort-on-the-Main, at Hoechst, May 8, it was announced that the German Dye Trust would pay a 10 per cent dividend on 1925 business. Constituent concerns of the former I. G., fused in a supertrust late last year, paid 8 per cent on 1924 operations. Clear profits are given as 64 million marks on 1925 business against a corresponding 54.7 million marks in 1924.

Corrosion Symposium for A.I.C.E. Summer Meeting—A symposium on corrosion will offer one of the outstanding features of the summer meeting of the American Institute of Chemical Engineers which will be held at Berlin, N. H., June 21-23. Opportunity also will be given for visits to the plants of the Brown Co.

Men You Should Know About

Dr. DAVID SPENCE, who retired about a year ago from the general managership of the Norwalk Tire & Rubber Co., Norwalk, Conn., has been appointed vice-president of The Continental Rubber Co. of New York, in charge of development of guayule rubber.

C. G. DERICK, formerly located in Buffalo where he was director of research for the National Aniline & Chemical Co., and engaged in consulting work, has been for some time plant manager of the Gary & Chesterton Chemical Co. of Chesterton, Ind., an organization engaged in the manufacture of intermediates and dyes.

Dr. WARREN FRED FARAGHER has resigned as assistant director of the Mellon Institute of Industrial Research, University of Pittsburgh, to become director of the Research Laboratory of the Universal Oil Products Co., Chicago, Ill. Dr. Faragher has been with

Warren Fred Faragher

the Institute since 1918, and a member of the executive staff since 1924. While at the University of Pittsburgh he organized the department of petroleum refinery technology in the School of Mines and has since served as the departmental head.

JAMES KENDALL, administrative head of the Department of Chemistry in the Washington Square College of New York University, sailed for England June 3. He expects to return September 1.

Dr. CHARLES RAYMOND DOWNS was married May 8, to Ruth Evelyn Clifford, at Lenox, Mass.

H. T. HERRICK, formerly with the National Aniline and Chemical Co., the American Aniline Products, Inc., the By-Products Steel Corp. and more recently the Grasselli Chemical Co. is now chemist in charge of the Color Laboratory of the Bureau of Chemistry, Washington, D. C.

N. A. C. SMITH has been appointed superintendent of the Petroleum Experiment Station of the Bureau of Mines, Department of Commerce, at Bartlesville, Okla.

Dr. EDGAR FAHS SMITH will be the recipient of the Priestly medal, at a ceremony to be held in Philadelphia during the fiftieth anniversary of the founding of the American Chemical Society, Sept. 6-11.

PAUL L. PALMERTON resigned his position on June 1, as chief of the Rubber Division, Department of Commerce, to head the Palmerton Publishing Co., and become editor and publisher of the *Rubber Age*, New York.

H. T. BRODERSEN has left his former position in Eastern Oregon to accept the position of chief chemist in the Pacific Coast factory of Johns-Manville, Inc., at Pittsburg, Calif.

PHILIP M. DINKINS, formerly sales manager, has been elected vice-president of the Kalbfleisch Corp., New York.

C. E. BALES resigned as assistant manager of the Louisville Fire Brick Works on May 31 to accept the position of production manager of the Ironton Fire Brick Co., Ironton, Ohio.

CHARLES B. OFFICER, hitherto assistant to the president on engineering matters, of the Sullivan Machinery Co., Chicago, has been appointed chief engineer of the company in charge of engineering matters.

E. L. PECK, manager of the Empire Gasoline Co., Bartlesville, Okla., was unanimously re-elected president of the Association of Natural Gasoline Manufacturers at its annual convention.

S. BELIAEFF has been appointed chief chemist of the Napon Rayon Corp., Clifton, N. J.

Dr. M. H. HAERTEL has resigned his position as treasurer of the Miner-Edgar Company of New York to take active charge of the campaign being made to obtain an increase in the duty on methanol. He will present the case of the domestic producers and refiners of methanol at the Tariff Commission hearing on June 17.

L. A. DEBLOIS has resigned as manager of the safety and compensation division of the service department of E. I. du Pont de Nemours and Co., Wilmington, Del., to become director of the safety engineering division of the National Bureau of Casualty & Surety Underwriters.

Dr. N. E. GORDON, state chemist and head of the department of chemistry at the University of Maryland, Baltimore, has sailed for a trip abroad to study chemical educational methods on the continent.

Dr. FREDERICK G. KEYES, director of the research laboratory at the Massachusetts Institute of Technology, Cambridge, Mass., has joined the faculty of Brown University, Providence, R. I., effective next September.

LEWIS ALBRECHT, general manager of the General Ceramics Co., New York, has sailed for a trip abroad to be absent for about three months. Mr. Albrecht has been convalescing from an operation for acute appendicitis.

At the May meeting of the Board of Trustees of the University of Illinois Professor Roger Adams was appointed head of the Department of Chemistry. Dr. Donald B. Keyes, director of research, U. S. Industrial Alcohol Co., was appointed professor of industrial chemistry.

HENRY KREITZER BENSON, professor of industrial chemistry and chemical engineering, University of Washington, Seattle, Wash., had conferred upon him the degree of Doctor of Science by Franklin and Marshall College, June 7. Prof. Benson received his A.B. from Franklin and Marshall in 1899, A.M., 1902, Ph.D. Columbia University, 1909. During the World War he was captain in the Ordnance Department of the U. S. Army.

Dr. SVANTE ARRHENIUS, Swedish scientist, has been awarded the first John Ericsson medal, by the American Society of Swedish Engineers, at a formal presentation ceremony held at the Hotel New Willard, Washington, D. C., on the evening of May 29, for his contributions to the progress of science, especially electrochemistry. Due to illness Dr. Arrhenius was unable to be present, so Eric A. Lof, president of the Society, tendered the medal through Mr. Enstrom, one of the official delegates from Sweden and a personal friend of the recipient.

Svante Arrhenius

The Montreal Section of the SOCIETY OF CHEMICAL INDUSTRY has elected the following officers for the ensuing year: A. G. Fleming, chief chemist of the Canada Cement Co., Ltd., president; J. R. Macaulay, secretary-treasurer; executive committee, A. Briant, M. C. C. McFee, A. A. Mellor, Dr. J. F. Snell, A. Valin and Dr. G. S. Whitby.

At the annual meeting of the CHEMISTS' CLUB, New York, the following officers were elected: President, Dr. T. B. Wagner; resident vice-president, C. R. Downs; non-resident vice-president, E. R. Weidlein of Pittsburgh; secretary, J. W. H. Randall; treasurer, A. G. Robinson; trustees, T. R. Duggan and Irving Hochstadter.

Obituary

Clement C. Speiden

CLEMENT C. SPEIDEN died May 25 at Malvern, England. Mr. Speiden had been abroad on a business trip for about three months when he became ill and members of his family were summoned and were with him when he died. Mr. Speiden who was 60 years old had been a prominent figure in the chemical industry for a number of years. Born in Virginia, he came to New York in 1885 and entered the employ of A. Klipstein & Co. He remained with that company for 21 years and left to become associated with the firm of Innis and Co. This was then incorporated as Innis, Speiden & Co., with Mr. Speiden as president and business director. He remained in that capacity until last February when he resigned as president and was elected chairman of the board of directors. He also was president of the Isco Chemical Co., Inc., and vice-president and director of the Isco-Bautz Co.

Mr. Speiden was a member of the Southern Society Reform Club, National Arts Club, Monday Night Glub, Highland Club, Short Hills Club of New Jersey, Drug and Chemical Club, Society of Chemical Industry, American Electrochemical Society, Chemists' Club, American Chemical Society, Merchants' Association, American Exporters' Association and Board of Trade and Transportation. He is survived by his wife, formerly Miss Mary Eleanor Wright of Hamilton, Ontario, whom he married on Oct. 12, 1892, and who was with him when he died, and by four children, Clement Leith Speiden, who was associated with him in business, John Gordon Ferrier Speiden, Mrs. R. V. Paddick and Miss Eleanor Leith Speiden.

DAVID SCHWARTZ, vice-president in charge of refining lard making for the South Texas Cotton Oil Co. of Houston, Texas, died suddenly in that city in February.

JOSEPH REDINGTON CHAMBERLAIN, president of the Caraleigh Phosphate and Fertilizer Works at Raleigh, N. C., died suddenly April 26, at the age of 64.

HERBERT F. DAVISON, assistant professor in inorganic chemistry at Brown University, suddenly stricken with a cerebral hemorrhage, passed away in Providence, April 28. He graduated from Brown University in 1905, and subsequently received his Master of Arts degree from his Alma Mater. Since that time he was a teacher of elementary chemistry, first at a private school in Concord, Mass., and then for many years at the Pawtucket high school. There he was assistant principal when he resigned in 1918 to come to Brown, where he had charge of the courses in freshman chemistry.

SAMUEL PRICE WETHERILL, SR., of Philadelphia, Pa., founder of the local paint manufacturing company which bears his name, died at his local residence on May 2, at the age of 80 years. He was formerly associated with John Price Wetherill and August Heckscher in the Lehigh Zinc and Iron Co., at South Bethlehem, Pa. He was active in the merger of several companies which composed the New Jersey Zinc Co., and was a director of that organization.

ROSCOE E. DOOLITTLE, chief of the central inspection district, Bureau of Chemistry, U. S. Department of Agriculture, died at his home in Evanston, Ill., April 26, after a brief illness.

Calendar

AMERICAN CHEMICAL SOCIETY, Philadelphia, Pa., Sept. 6 to 11.

AMERICAN ELECTROCHEMICAL SOCIETY, Washington, D. C., Oct. 7, 8 and 9.

AMERICAN INSTITUTE OF CHEMICAL ENGRS., Berlin, N. H., June 21-24, 1926.

AMERICAN ELECTROPLATERS SOCIETY, convention, Salaam Temple, Newark, N. J., June 28-July 1.

AMERICAN GAS ASSOCIATION, Eighth annual convention and exhibition, Atlantic City, N. J., Oct. 11 to 15.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, spring meeting, San Francisco, Calif., June 28 to July 1.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Atlantic City, N. J., June 21 to 25.

COLLOID SYMPOSIUM (Fourth Annual), Mass. Inst. of Tech., Cambridge, Mass., June 23 to 25.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING (5th) Grand Central Palace, New York, Dec. 6 to 11.

SESQUI-CENTENNIAL INTERNATIONAL EXPOSITION, Independence Sq., Philadelphia, Pa., June 1 to Dec. 1.

SOUTHERN EXPOSITION (2nd Annual), Madison Sq. Garden, N. Y., Oct. 2-10.

Industrial Notes

VICTOR HYBINETTE of Wilmington, Del., is closing his New York office at 300 Madison Ave.

THE WATSON-STILLMAN CO., New York, announces that Francis T. West, who has been the Western Manager with headquarters in Chicago for the past twenty-five years, has retired. He will be succeeded by J. F. Coyne, with offices at 549 West Washington Boulevard. The company has also established an office at 7752 Duboise St., Detroit, Mich., with Earle W. Porter, as manager.

THE SULLIVAN MACHINERY CO., Chicago, announces that its northwestern sales office at Spokane, Washington, will be at 120 South Lincoln Street, instead of in the Hutton Building.

FREDERIC B. STEVENS, LTD., has been established with main office and warehouse in Toronto, Canada, at 139 Royce Ave. This Canadian company will handle and service the entire Stevens line of foundry facings and supplies, platers, equipment, etc., for the Canadian trade, and will also represent the Quigley Company of Canada for the sale and service of Hytempite, acid-proof cement, and other Quigley products in Ontario.

THE W. N. BEST CORP., New York, announces that Frank A. Hall has joined its Dempsey Furnace Division. Mr. Hall has been active for five years in industrial furnace work in Philadelphia, prior to which he was engaged in metallurgical work for Wright-Martin Aircraft, Driver-Harris and the New Jersey Tube Co.

THE AJAX ELECTROTHERMIC CORP. is now located at Ajax Park, Trenton, N. J.

THE ATLANTIC TANK & BARREL CORP. has moved to its new plant at Tonnele Ave. and Hamblet Place, North Bergen, N. J. The new buildings are much larger than those that were destroyed by fire several months ago, and cover approximately seven acres of land, located along the Erie railroad.

THE POWER SPECIALTY COMPANY, of New York, has acquired the Aero Pulverizer Co., manufacturers of Aero unit coal pulverizers, thus enabling the Power Specialty Co. to provide complete steam generating units with the exception of the boiler.

THE AMERICAN ENGINEERING COMPANY of Philadelphia announces the appointment of H. Kempner as sales manager of its "Lo-Hed" electric hoist division.

HALL-WILL, INC., Erie, Pa., will shortly put on the market a new type threader, the "Red-E-Hall," portable pipe threader, capacity ¼ inch to 2 inches, to be followed as quickly as possible by a line of larger machines.

THE FOOTE BROS. GEAR AND MACHINE CO., Chicago, Ill., have appointed Francis A. Emmons, for the past two years advertising manager, as sales manager.

THE CINCINNATI BUTCHER'S SUPPLY CO., of Cincinnati and Chicago, has acquired the services of John P. Harris, chemical engineer, who has recently been director of packing house practice and research for the Institute of American Meat Packers.

THE LINK-BELT CO., Chicago, announces that Nelson Brandt has rejoined its sales management force, and that he will manage a new branch office which is to be opened up in Florida.

THE NITROGEN ENGINEERING CORP., have moved to larger quarters at 331 Madison Ave., New York.

THE PFAULDER CO., Rochester, N. Y., are moving the executive offices into larger quarters in the new Rochester Gas & Electric Building, where they will occupy the entire 10th floor and part of the 9th floor.

THE BRIDGEPORT BRASS CO., Bridgeport, Conn., announces the appointment of Charles H. Clark as raw material salesman for the State of Massachusetts and the cities of Providence, R. I., and Meriden, Conn.

THE FATE-ROOT-HEATH CO., Plymouth, Ohio, has placed John H. Neafie and George H. Fanning with offices at 50 Church Street, New York, in charge of its district sales office in the New York territory.

THE ROBERT JUNE ENGINEERING MANAGEMENT ORGANIZATION of Detroit has moved to larger quarters at 2208 West Grand Boulevard where it now occupies the entire building.

THE H. H. ROBERTSON CO. announces the removal of its New York City office from 170 Broadway to 475 Fifth Ave. Dave W. Robertson is manager.

THE OHIO ELECTROLYTIC OXYGEN CO., of Cincinnati, Ohio, has changed its name, and is now the Ohio Valley Oxygen Co.

FRANK HODSON, consulting engineer, 1015 Chestnut St., Philadelphia, formerly founder and president of the Electric Furnace Construction Company, Philadelphia, advises that he has signed contracts with F. T. Kaelin of Montreal for the exclusive rights of Mr. Kaelin's system, process and patents on the "Kaelin" electric steam boiler for U. S. A. and South America.

THE LAMOTTE CHEMICAL PRODUCTS CO., Baltimore, Md., at its annual meeting of the Board of Directors, elected the following officers: President, W. A. Taylor; vice-president and treasurer, F. W. Burr, and secretary and assistant treasurer, Miriam Welch.

THE TIMKEN ROLLER BEARING SERVICE AND SALES CO., located at 1033 Cathedral Street, Baltimore, Md., was closed May 1 and the service requirements of this territory will be supplied through the Richmond, Pittsburgh and Philadelphia branches. T. F. Rose, formerly assistant branch manager of the Chicago branch has been appointed branch manager of the Cincinnati branch. H. C. Sauer, formerly assistant branch manager at Cleveland is now manager of the Detroit branch. Fred G. Rumball, formerly branch manager of the Kansas City branch has been promoted to the position of sales engineer, automotive division, with headquarters in Cleveland. It is also announced that H. E. Gilmore will become manager of the St. Louis branch. The Omaha branch office now occupies quarters at 2240 Douglas Street, under the direction of A. D. Hackim. The new home of the Los Angeles branch will be at 1361 South Figueroa Street. It is also announced that G. W. Curtis has been promoted from industrial equipment engineer to district manager of sales, industrial division, for the Milwaukee territory. Mr. Curtis will work with R. W. Ballentine who previously has handled this territory. S. M. Weckstein succeeds Mr. Curtis as industrial equipment engineer.

High Refining Loss Affects Prices for Cottonseed Oil

Record Domestic Consumption Creates Stringency in Supplies and Contributes to the Enhancement of Market Values

AT THE beginning of the 1925-26 cottonseed oil year, opinion in trade circles was almost unanimous in favoring a low-priced period for crude and refined oils. To start with there was a carryover equivalent to 474,000 bbl. of refined oil. In the second place, a large increase over the preceding season had been recorded in the cotton crop. With a larger seed supply, it was logical to look for a more or less corresponding increase in production of oil which, with the carryover would offer a total supply for the year far in excess of what had come to be regarded as normal requirements.

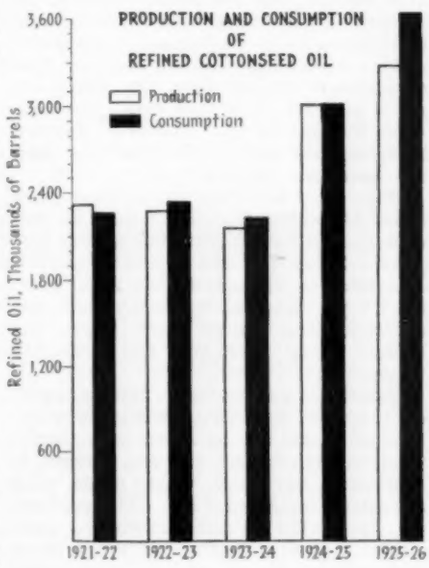
These expectations seemed destined to be realized when early ginning reports revealed that cotton was being marketed in large volume. Under the influence of large offerings of seed, the market for crude cottonseed oil eased off in price and refined oil not only followed suit but took the lead in the downward movement. From October on, however, the trend of values was almost continuously upward and the rise in values became more pronounced as the season advanced.

This remarkable upset to price calculations is attributed to two important factors. Production of refined oil did not show an increase over the preceding season commensurate with the increase in seed supplies. Loss in refining crude oil ran exceptionally high and cut deeply into the output of the refined product. In the preceding season refining loss was reported at about 9 per cent while for the present season 17 per cent is given as a fair average with some reports running as high as 25 per cent loss. The second factor which had an important part in establishing high prices was found in the record consumption of oil among domestic industries.

In the latter part of the 1924-25 season, the disappearance of cottonseed oil was on a large scale. This was explained by the strong position of the market for hogs and lard and the consequent stimulus given trading in lard compound which offers the largest outlet for cottonseed oil. To a certain extent the lard market may be credited with helping demand for cottonseed oil in the present season but within the past few days the price for oil has crossed that for lard and current oil values are dominated by the law of supply and demand.

Production of refined oil is given in the accompanying tables, the totals representing consumption as reported monthly by the government with due allowance for the difference in carryover at the beginning and end of the respective seasons. Figures also are given to show monthly prices and consumption of refined oil.

In order to overcome a possible shortage in oil supplies, attempts have been made to import cottonseed oil. There is a difference of opinion regarding the amount of foreign oil which has been bought for shipment to this country but well informed members of the trade say this movement was not started early enough to offer much relief and that about 75,000 bbl. is all that can be expected before new crop domestic oil comes on the market. Scarcity of tonnage is said to be the chief obstacle to foreign trade as prices abroad are below the domestic parity.



Production and Consumption of Refined Cottonseed Oil

Crop Year	Production, Bbl.	Consumption Bbl.
1925–26	3,298,000	3,650,000
1924–25	3,190,000	3,019,000
1923–24	2,162,000	2,236,000
1922–23	2,271,000	2,340,000
1921–22	2,320,000	2,260,000

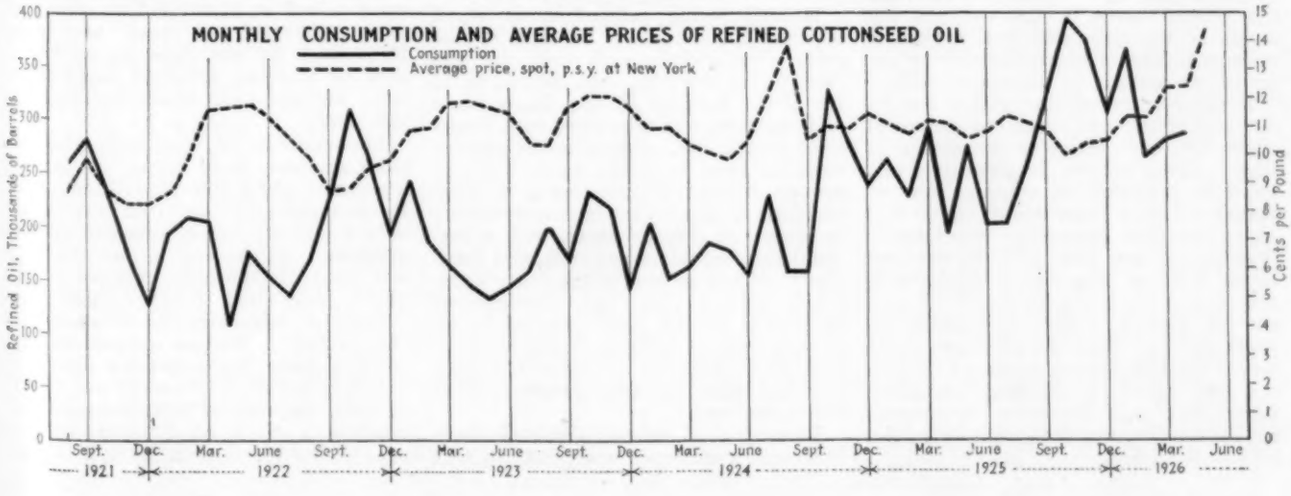
Average Monthly Prices for Spot P.S.Y. Cottonseed Oil at New York

	1925–26	1924–25	1923–24	1922–23	1921–22
August	11.16	13.85	10.31	9.95	8.69
September	10.82	10.52	11.62	8.70	9.88
October	9.91	11.03	12.06	8.88	8.69
November	10.31	10.86	11.65	9.50	8.30
December	10.47	11.41	11.00	9.81	8.28
January	11.34	11.17	11.01	10.83	8.62
February	11.27	10.70	10.36	10.90	9.91
March	12.33	11.15	9.76	11.77	11.53
April	12.40	11.09	10.08	11.81	11.57
May	14.50	10.55	9.82	11.60	11.71
June	.....	10.77	10.43	11.42	11.30
July	.....	11.36	12.07	10.35	10.69

Monthly Consumption of Refined Cottonseed Oil

	Crop Year 1925–26, Bbl.	Crop Year 1924–25, Bbl.	Crop Year 1923–24, Bbl.	Crop Year 1922–23, Bbl.	Crop Year 1921–22, Bbl.
August	254,000	157,000	203,000	169,000	259,000
September	321,000	157,000	169,000	229,000	283,500
October	395,000	328,000	232,000	309,000	233,500
November	375,000	281,000	219,000	263,000	173,500
December	309,000	238,000	145,000	194,000	129,000
January	369,000	262,000	203,000	242,000	192,000
February	266,000	228,000	153,000	187,000	208,500
March	282,000	293,000	162,000	164,000	204,000
April	288,000	193,000	188,000	148,000	109,500
May*	.....	278,000	179,000	133,000	179,500
June*	.....	302,000	153,000	143,000	152,000
July*	.....	302,000	230,000	159,000	136,000
	2,859,000	3,019,000	2,236,000	2,340,000	2,260,000

* Figures not yet available, but estimates place 800,000 bbl. as probable consumption for the three months, which would give a total of 3,659,000 bbl. as consumption for 1925–26.



Market Conditions and Price Trends

Price Advances Feature Trading in Vegetable Oils and Fats

Weighted Index Number for Chemicals Also Moved Upward Under the Influence of Higher Schedules for Sulphuric Acid

ADVANCES in selling prices for vegetable oils in the past month have been unusually drastic and have attracted wide attention to those commodities. Because of its large tonnage cottonseed oil is the most important oil of this group and it attained even greater prominence throughout the period because it was responsible for the upward swing which characterized the oil market.

An analysis of conditions affecting market values results in another tribute to the infallibility of the law of supply and demand. Apparent consumption of cottonseed oil for the present season has been running far ahead of production with the result that visible stocks are not regarded as large enough to satisfy consuming needs until new crop will be available. The result was inevitable and price advances were hastened by the presence in the market of short interests who created a consistent buying power in their attempts to cover their commitments.

Peanut and corn oils generally follow the leadership of cottonseed oil but in the present instance their move to higher ground was not purely sympathetic but was the outgrowth of a belief in a shortage of edible oils. Linseed oil also was higher in price but this movement was based on higher producing costs as represented by advances in the seed market.

With the majority of oils and fats selling at advanced levels a very material gain was recorded in the weighted index number. It now stands at 169.79 as compared with 154.49 a month ago and 153.87 a year ago.

Price movements in the market for chemicals were less spectacular but the weighted number moved to a higher level and is recorded at 113.67 which compares with 111.64 a month ago and 111.76 a year ago. Sulphuric acid was the prime factor in the advance but denatured alcohol also was higher in price and sales of benzol throughout the month were made at advanced levels.

Reports on conditions within the industries which are large consumers of chemicals are irregular inasmuch as they indicate activity in some lines and marked recessions in others. For instance a report from Akron states that early June tire production schedules in that district are from 15 to 20 per cent below those of May and from 40 to 45 per cent under the peak levels. A survey of leading rubber companies reveals the fact that the attitude of the larger manufacturers seems to be that the best policy is to keep curtailing production until excessive inventories are depleted rather than stimulate sales by cutting prices.

Nearly 20,000,000 automobile casings, or about three months' supply for the entire country, are estimated to be in the hands of manufacturers. Dealers' stocks of around 6,000 tires are considered normal, but the surplus carried in factory warehouses and branches is more than twice as large as last year. A record breaking demand for tires was anticipated during May, but early reports of sales show that retail business was disappointing. Adverse factors have been the unseasonable weather and the uncertain price situation.

Reports of fertilizer tag sales in May show an increase of more than 27 per cent over the corresponding period last year. Sales for the 6-month period, December to May, however, were more than 7 per cent below the total for the corresponding period last year, the figures being 4,621,860 and 4,657,276 respectively.

Based on employment figures gathered by the Bureau of Labor, production of chemicals in April was larger than in March and the comparison is still more favorable when made with operations in April, 1925. The position of consuming trades, however, generally showed a falling off from those reported in March and it is probable that production has been outstripping consumption.

The index of employment in the chemical trade and in the leading consuming industries offers the following comparisons:

WEIGHTED INDEX OF EMPLOYMENT

	April 1926	March 1926	April 1925
Dyeing and finishing textiles	99.7	101.6	103
Leather	91.1	93.4	90.2
Paper and pulp	96.1	95.6	96.3
Chemicals	95.7	95.4	93.4
Fertilizers	137.5	153.1	153.0
Glass	100.0	100.6	94.1
Automobile tires	111.6	111.8	110.3
Petroleum refining	98.9	97.4	90.6

Manufacturing production in April was the highest since the end of the war, when allowance is made for differences in working time, according to the index number of the Department of Commerce, and was 2 per cent larger than a year ago. Owing to the shorter working time in April, most industry groups showed slightly lower production than in March, exceptions occurring in stone and clay products, with a seasonal increase of 18 per cent, and foodstuffs, with a gain of 5 per cent. Compared with a year ago, increases of from 5 to 14 per cent occurred in all groups except textiles, leather, stone and clay products, metals other than iron and steel, and miscellaneous, all of which declined.

Raw-material output declined from March in a seasonal movement but was 2 per cent higher than in April, 1925. Compared with a year ago, increases occurred in minerals and crops, while animal products declined and forest products showed no change.

Owing to increases in the stocks of both raw and manufactured foodstuffs, the index of stocks on hand increased during April, when corrected for seasonal variation, though raw materials declined and manufactured goods remained the same. Compared with a year ago, stocks were larger, only manufactured goods declining.

The index of unfilled orders on April 30 was lower than for either the previous month or a year ago, owing to declines in the iron and steel group, as building materials showed little change from either period.

Export trade in chemicals and allied products showed a gain of more than 10 per cent over that for April, 1925. A substantial gain in outward shipments of coal-tar products was largely due to a marked increase in foreign call for benzol. Sodium compounds also were shipped in larger volume with borax, soda ash, silicate of soda, and bicarbonate of soda showing the greatest improvement. Paints and pigments also recorded a gain. Exports of fertilizer and fertilizer materials were valued at $2,007,394 as compared with $1,561,232 for April last year. Explosives did not show up so favorably as a group although some selections surpassed the totals for April of last year.

Importations of chemicals and related products were valued at slightly less than those for April last year. Marked gains in quantities were made in the coal-tar list by creosote oil and pyridine. In the acid group attention was drawn to the large receipts of sulphuric acid and it is evident that Canada is increasing its shipments to this country. Barium compounds also came in more freely and the same was true for carbonate of potash and nitrite of soda. Imports of fertilizer materials reached a total of 211,540 tons as against 246,939 tons in April last year.

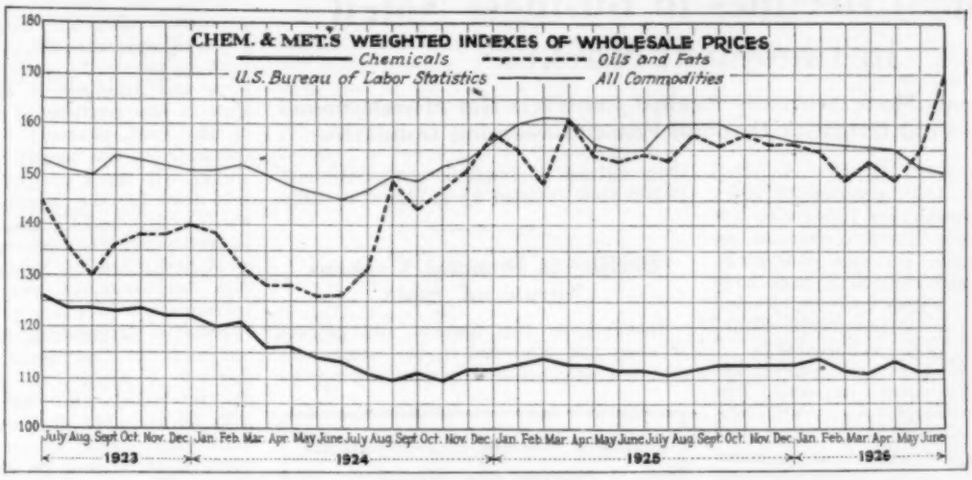
Dye Imports Continue to Show Falling Off

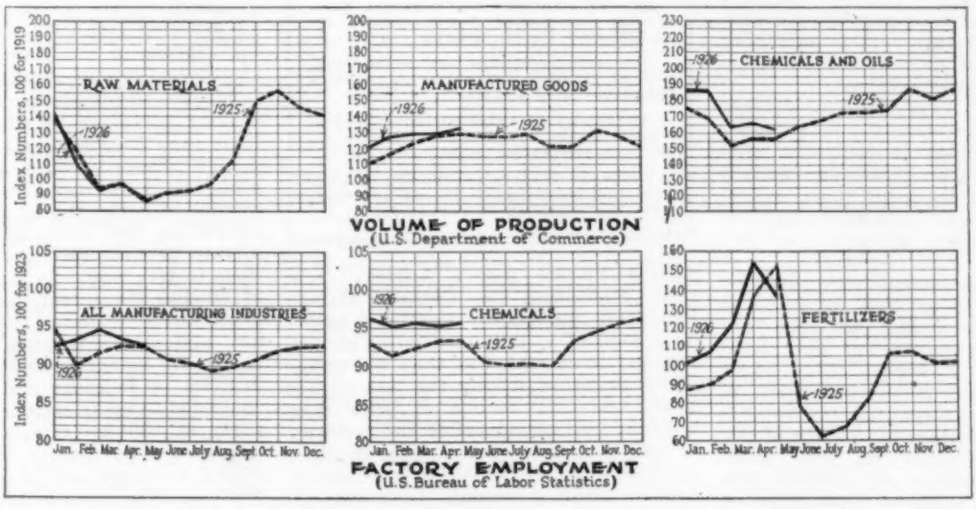
Imports of synthetic dyes in May were 392,759 lb. which shows a falling off as compared with the totals for the months preceding. Total imports for the 5 months ended May also were less than those for the corresponding period of 1925. Imports by months compare as follows:

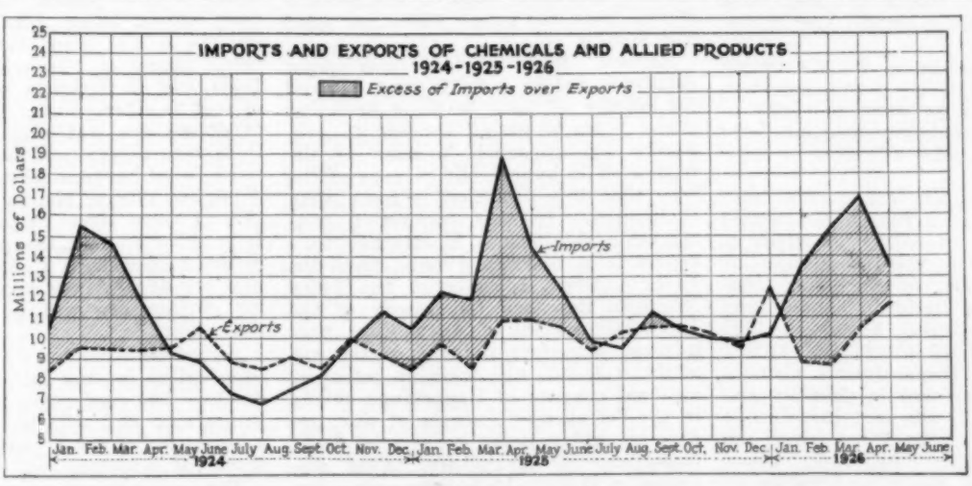
	1926 Lb.	1925 Lb.
January	190,459	403,984
February	479,027	373,259
March	487,804	527,964
April	437,526	451,005
May	392,739	370,271
Total	1,987,555	2,126,483

Chem. & Met.'s *Statistics of Business*

In The Chemical Engineering Industries







Market Conditions and Price Trends

Seasonal Declines in Business Noted in Chemical Market

Basic Chemicals Move Normally Against Contracts But Miscellaneous Selections Find Irregular Demand From Consuming Industries

SPOT transactions in the chemical market have been reasonably quiet and different consuming industries appear to have cut down somewhat on their requirements for raw materials. Deliveries against contracts have been going forward with uniformity and total consumption of important chemicals is reported to be satisfactory.

In some cases a good business has been reported for future delivery. For instance it is stated that domestic producers of fluoride of soda have sold freely on contract and that a large part of domestic consumption has been covered for the remainder of the year. If this is correct, competition from imported fluoride will be less prominent in the near future although the spot market may be weakened temporarily. Bichromates also are said to have been offered for later deliveries with prices based on quantities involved.

As had been expected the advance in sulphur prices, resulted in a higher market for sulphuric acid and contracts for the latter have been written at advanced levels with some indications that further advances may be made on deliveries in the latter part of the year.

In spite of occasional low prices for resale lots of denatured alcohol, the undertone to the market has been firm and leading producers not only have openly quoted at higher price levels but have refused to accept orders at current prices except for nearby delivery. On the other hand some of the solvents have shown an easy tone. Butanol was lowered one-quarter cent per gal. and furfural was marked down to 15c. per lb. for car lots and 17½c. per lb. in 500-lb. drums. Benzol has continued to find a receptive market and the limited stocks on hand have made it easy to maintain the higher quotation price.

Lower average prices for tin during May were responsible for a reduction in the schedules for June deliveries of tin salts. Zinc sulphate also has been easier and the same was true of antimony products.

Sellers of sodium compounds have shown interest in a report just issued by the Bureau of Mines in which it was stated that the production of sodium compounds, not including common salt, from natural salines and brines in the United States in 1925 amounted to 73,300 short tons, valued at $2,095,110. These figures show a decrease of 4 per cent in quantity and an increase of 15 per cent in value as compared with 1924. They cover the output of sodium carbonate, bicarbonate, sulphate, trona, and borate in various forms. The sales of sodium sulphate in 1925, comprising natural salt cake and Glauber's salt, were 9,940 tons, valued at $84,380, compared with 16,200 tons, valued at $174,600 in 1924.

Decline in Demand Weakens Nitrate of Soda

Interest in the market for nitrate of soda has centered in the announcement of prices for shipment during the coming nitrate year. Advices from Chile state that the Chilean Nitrate Producers Association has fixed prices on a basis of 1 shilling, English money, per metric quintal, less than the prices which prevailed during the last nitrate year. As this decline in price does not take into consideration the recovery in Sterling, it is not equivalent to a corresponding price decline in terms of United States currency. Domestic importers, however, have made public a price schedule in which shipment prices range from $2.33 to $2.53 per 100 lb. and the latter figures represent a decline from the prices which prevailed last season.

Reports from various consuming countries plainly indicate that demand for nitrate of soda is on a declining scale. This is giving concern to producers not so much because of the falling off in buying but because of the fear that this condition is more than temporary. In this connection considerable significance is attached to a report from Biarritz, France, from Dr. F. G. Cottrell, Director of the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture, that nitrates manufactured out of the air, which a decade ago were an intensely national concern of importance chiefly in the destructive business of war, are now an international concern of basic importance to agriculture, being discussed at Biarritz by nations only a few years ago at war with each other. America, Belgium, France, Germany, Great Britain, Holland, Italy, Java, Norway and Sweden, at once the chief producers and the largest consumers of artificial nitrates, are represented here by scientists and economists whose hope and ambition is mutual co-operation in the capture of more and more of the vast, scarcely tapped mines of nitrogen in the air all about us, to be chemically fixed and eventually turned into food for the increasing millions of the earth's population. Through improved methods in nitrogen fixation and a stabilization of marketing, continuing decreases in fertilizer costs to farmers are in plain prospect.

Another interesting report to the Department of Commerce says that production of nitrate in the Antofagasta district within the past 6 months was over 50 per cent of the total for Chile. While the season for heavy nitrate exports usually ends in March and April of each year, and the decrease in exports for March this year was expected, yet the total for the quarter, as compared with that of 1925, shows a decrease of 61,000 metric tons, or almost 18 per cent less. This is the disturbing feature of the leading industry of Northern Chile at present.

Stocks of nitrate carried along the coastal ports amounted in April to a little over 100,000 tons, and while producers naturally want to keep their plants working, it does not pay to carry nitrate of soda stocks for too long a period, as the chemical action of the nitrate on the jute bags finally causes them to give way. So far no other plan of storing the nitrate has been found practical. The loss of the German market, and now a portion of other mid-European markets, and exchange difficulties in Belgium and France, have combined to make serious inroads in exports of Chilean nitrate to European markets. The United States is now taking over one half of the entire production. The main cause for the present slump is the falling off of purchases by American consumers. Two of the largest local producers have recently closed several plants. "El Loa" Company closed three plants, and Barburizza & Co. also closed three, one being placed in the hands of a caretaker, and all workmen either dismissed or sent to other points. It appears that producers are watching market conditions very closely, and biding their time to see what happens when the new huge American nitrate plant under construction at Coya Norte begins to produce. It is expected that the plant will open in September, with a capacity of 1,000 tons per day. A new process for treating nitrate ore will be employed at this plant.

A conference of nitrate producers has been called for the latter part of this month. The conference will be held at Valparaiso and will be given over to a discussion of the problems which confront the industry.

The loss if European trade in nitrate is regarded as highly important. It is estimated by British experts that the consumption is likely to reach only

Leading Market Developments During the Month

Investigation will follow charge that German makers are dumping strontium nitrate in domestic markets.

The Chilean Nitrate Producers Association announced lower prices for nitrate of soda for coming year.

Permanent embargo against importation of synthetic phenol resin products asked at Tariff hearing.

All grades of sulphuric acid sold at higher levels last month owing to increased production costs.

Domestic makers of fluoride of soda are reported to have closed contracts with the majority of consumers.

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.67**
Last month	111.64
June, 1925	111.76
June, 1924	112.92

During the month higher prices prevailed for sulphuric acid, denatured alcohol, and phenol and this more than offset an easier tone in the case of some minor selections with the result that the index number moved upward.

2,050,000 tons for the year up to June 30, 1926, against 2,340,000 tons for the previous year. The reason for this appears to be the lower price at which sulphate of ammonia and synthetic nitrogen products have been marketed, and the more efficient European selling organizations and system of marketing, which insure a satisfactory profit to distributors, whereas the competition among continental importers has made this impossible in the case of Chilean nitrate.

It is estimated that stocks on hand in Europe at the end of June will approximate 250,000 tons and that stocks in the United States will be close to 150,000 tons.

Coming Tariff Hearing Creates Interest in Methanol

A public hearing will be conducted on June 17, by the Tariff Commission, on the application for a 50 per cent increase in the import duty on methanol. The question of a change in duty will rest largely with a comparison of producing costs in this country and in Germany. The latter country is reported to be the only one which has shipped synthetic methanol to the United States. In reporting its investigations the Tariff Commission stated that the one Germany company producing synthetic methanol and supplying the entire export to the United States refused to submit its costs of production. For comparison with domestic costs, the commission, therefore, is restricted to invoice prices of imports from Germany. As the Customs Division of the United States Treasury Department, after an investigation of the charge of dumping, declined to issue a finding in the case, it appears probable that the invoice price of imports into the United States has not been below the market price in Germany. The average invoice price, less the included shipping charges, may therefore be taken as at least equal to if not greater than the German cost of production. Therefore the comparison is made, not on the assumption that the German prices and costs are identical, but on the assumption that in the absence of any evidence of dumping it may be held that the invoice prices contained some element of profit.

The weighted average price of imports during 1925 was 48.12c. per gal., c.i.f. New York. Shipping charges included in this c.i.f. price averaged 3.21c. per gal., leaving a net return to the producer of 44.91c. per gal. Taking these figures as indicative of German producing costs and the cost figures as submitted by domestic manufacturers, the following comparison of costs in cents per gal. is afforded:

	United States 1925 (First 6 Months)	United States 18 Month Period	Germany 1925
Cost or price, f.o.b. plant	67.17	71.20	44.91
Transportation charges to New York	4.73	5.12	3.21
Total cost, New York, duty not included	71.90	76.32	48.12

Manufacturing activity among domestic manufacturers of refined methanol for the first 4 months of the year may be seen from the following figures which were issued by the Department of Commerce:

	Produced Gal.	Stocks End of Month Gal.
January	596,997	637,300
February	483,059	636,699
March	559,505	557,711
April	525,008	623,538
Total (4 mos.)	2,164,569	.....

Official returns show that imports of methanol in March were 71,749 gal. valued at $32,590 which compares with importations of 43,486 gal. valued at $19,937 in February. This is equivalent to an average price of fractionally more than 45c. per gal. which, with the addition of import duty would represent a laid down cost of more than 57c. per gal.

Firmer Tone in Market for Calcium Arsenate

While there has been no activity in calcium arsenate, the market has attracted attention because of the firmness with which prices have been maintained. It has been conceded that buying has been of small volume and that large stocks, probably close to 7,000 tons, are held in distributors hands, yet asking prices have been advanced and sellers appear to have adopted a policy of holding out for the higher prices rather than attempt to stimulate buying interest by a cut-price program. Production is said to be at a standstill as producers have been waiting for surplus stocks to be taken up before turning out fresh supplies. So far there has been nothing in the buying movement, either actual or prospective, to encourage new production and it is questionable if carryover stocks will be entirely absorbed. Reports of weevil infestation have not been numerous and indications point to a slow season. The outlook is improving, however, as it is certain that present holdings of arsenate will be drawn on to some extent and also because of the apparent cessation of price-cutting among sellers. Imports of arsenic for the 10 months ended April are officially given as 10,252,248 lb. as compared with 12,969,567 lb. for the corresponding period last year. Domestic production of arsenic also is reported to be along moderate lines.

According to statistics of the Department of Commerce 7,702,069 lb. of arsenic were used to produce 19,911,262 lb. of calcium arsenate in the year ended June 30, 1925. Sales of calcium arsenate in the same period amounted to 13,207,917 lb. and there were on hand at the end of that period 15,558,214 lb. of arsenate. Hence the supply on hand would prove more than enough for the current year's demands unless the latter show an increase.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**169.79**
Last month	154.49
June, 1925	153.87
June, 1924	126.30

An almost general price advance featured trading in oils and fats in the past month. Most prominent were rises in cottonseed, coconut, corn, and peanut oils. Glycerine also was sharply higher. Castor and Menhaden oils sold at lower levels than a month ago.

Exports of Chemicals

	April, 1926	April, 1925
Benzol, lb.	18,063,885	7,256,278
Aniline oil and salts, lb.	1,485	48,195
Acid, acetic, lb.	43,627	69,552
Acid, boric, lb.	156,954	63,984
Acid, sulphuric, lb.	1,029,287	891,340
Methanol, gal.	26,794	34,321
Aluminum sulphate, lb.	2,758,289	3,804,030
Acetate of lime, lb.	503,472	1,638,526
Calcium carbide, lb.	476,957	486,413
Bleaching powder, lb.	1,808,688	2,462,471
Copper sulphate, lb.	510,931	772,783
Formaldehyde, lb.	215,520	109,585
Potassium bichromate, lb.	12,921	22,970
Sodium bichromate, lb.	580,539	649,632
Sodium cyanide, lb.	284,023	146,783
Borax, lb.	3,228,240	2,659,677
Soda ash, lb.	3,546,129	2,164,958
Sodium silicate, lb.	4,581,058	3,065,457
Sal soda, lb.	817,680	771,985
Caustic soda, lb.	8,014,201	8,340,359
Sulphate of ammonia, ton	11,054	9,637
Sulphur, ton	42,009	47,090

Imports of Chemicals

	April, 1926	April, 1925
Dead or creosote oil, gal.	7,683,491	2,946,907
Pyridine, lb.	2,467,645	43,219
Arsenic, lb.	866,454	1,921,120
Acid, citric, lb.	30,016	194,322
Acid, formic, lb.	224,059	175,241
Acid, oxalic, lb.	102,802	142,734
Acid, sulphuric, lb.	7,100,590	2,501,600
Acid, tartaric, lb.	57,098	285,598
Ammonia chloride, lb.	1,397,996	897,444
Ammonia nitrate, lb.	574,193	872,382
Barium compounds, lb.	2,740,948	1,151,326
Calcium carbide, lb.	610,945	883,185
Copper sulphate, lb.	154,103	192,608
Bleaching powder, lb.	210,487	242,645
Potassium cyanide, lb.	889,644	.....
Potassium carbonate, lb.	1,174,883	639,484
Potassium hydroxide, lb.	675,592	1,855,594
Potassium chlorate, lb.	893,745	1,536,758
Sodium cyanide, lb.	2,510,254	3,706,840
Sodium ferrocyanide, lb.	51,174	186,081
Sodium nitrite, lb.	345,164	9,636
Sodium nitrate, ton	124,370	155,163
Sulphate of ammonia, ton	345	1,710

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to June 14.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl	cwt.	3.25 - 3.50	3.25 - 3.50	3.00 - 3.25
Boric, bbl	lb.	.09 - .10	.08½- .10	.08 - .10
Citric, kegs	lb.	.45 - .47	.45 - .47	.45½- .47
Formic, bbl	lb.	.10½- .11½	.10 - .11	.10½- .10¾
Gallic, tech., bbl	lb.	.50 - .55	.45 - .50	.45½- .47
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06½- .07
Lactic, 44%, tech., light, bbl	lb.	.13½- .14	.11½- .12	.13 - .13½
22%, tech., light, bbl	lb.	.06½- .07	.05½- .06	.06 - .06½
Muriatic, 18°, tanks	cwt.	.80 - .85	.80 - .85	.80 - .85
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.04 - .04½
Oleum, tanks, wks	ton	18.00 -20.00	18.00 -20.00	16.00- 17.00
Oxalic, crystals, bbl	lb.	.10½- .11	.10½- .11	.10½- .11
Phosphoric, tech., c'bys	lb.	.07 - .07½	.07 - .07½	.07½- .08
Sulphuric, 60°, tanks	ton	10.50 -11.00	9.50 -10.00	8.00 - 9.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl	lb.	.29 - .30	.28 - .30	.29 - .30
Tungstic, bbl	lb.	1.00 - 1.20	1.00 - 1.20	1.20 - 1.25
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	4.90 - 5.00	4.90 - 5.00	4.90 -.....
Alcohol, Butyl, dr	lb.	.18½- .19	.18½- .19	.27 - .30
Denatured, 190 proof				
No. 1 special dr	gal.	.28 - .40	.28 - .40	.50½-.....
No. 5, 188 proof, dr	gal.	.28 - .32	.28 -.....	.50½-.....
Alum, ammonia, lump, bbl	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl	lb.	.05½- .05½	.05½- .05½	.05½- .06
Potash, lump, bbl	lb.	.02½- .03½	.02½- .03½	.02½- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg	cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums	lb.	.03½- .04	.03½- .04	.06½- .06¾
Ammonia, anhydrous, cyl	lb.	.13 - .15	.13 - .15	.28 - .30
Ammonium carbonate, powd. tech., casks	lb.	.07½- .08½	.08½- .10	.12½- .12½
Sulphate, wks	cwt.	2.55 -.....	2.60 -.....	2.55 -.....
Amylacetate tech., drums	gal.	1.80 - 1.90	1.80 - 2.00	2.75 - 3.00
Antimony Oxide, bbl	lb.	.14½- .15	.14½- .15	.16 - .16½
Arsenic, white, powd., bbl	lb.	.03½- .04½	.03½- .04½	.04½- .05
Red, powd., kegs	lb.	.11 - .11½	.12 - .12½	.13½- .14
Barium carbonate, bbl	ton	48.00 -50.00	48.00 -50.00	51.00 -56.00
Chloride, bbl	ton	63.00 -65.00	63.00 -65.00	66.00 -70.00
Nitrate, cask	lb.	.07½- .08	.07½- .08½	.07½- .08
Blanc fixe, dry, bbl	lb.	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	1.90 -.....
Borax, bbl	lb.	.05 - .05½	.05 - .05½	.05 - .05½
Bromine, cs	lb.	.45 - .47	.45 - .47	.47 - .48
Calcium acetate, bags	cwt.	3.25 - 3.50	3.25 - 3.50	2.75 - 2.80
Arsenate, dr	lb.	.07½-.....	.06 - .07	.06 - .08
Carbide drums	lb.	.05½- .06	.05½- .06	.05 - .05½
Chloride, fused, dr., wks	ton	21.00 -.....	21.00 -.....	21.00 -.....
Phosphate, bbl	lb.	.07 - .07½	.07 - .07½	.06½- .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.06 - .06½
Tetrachloride drums	lb.	.06½- .07	.06½- .06½	.07 - .07½
Chlorine, liquid, tanks, wks	lb.	.04 - .04½	.04 - .04½	.04½-.....
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks	ton	15.00 -18.00	15.00- 18.00	13.00 -14.00
Copper carbonate, bbl	lb.	.16½- .17	.16½- .18	.16½- .17
Cyanide, tech., bbl	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl	cwt.	4.75 - 5.00	4.75 - 5.00	4.65 - 4.85
Cream of tartar, bbl	lb.	.21 - .22	.21 - .22	.21 - .21½
Epsom salt, dom., tech., bbl	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.30 - 1.40	1.30 - 1.40	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.80 - .82	.82 - .85	.87 - .90
99%, dr	gal.	1.01 -.....	1.03 -.....	1.03 - 1.06
Formaldehyde, 40%, bbl	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Furfural, dr	lb.	.15 - .17½	.17½-.....	.23 -.....
Fusel oil, crude, drums	gal.	1.35 - 1.40	1.40 - 1.50	2.70 - 3.00
Refined, dr	gal.	2.50 - 3.00	2.50 - 3.00	4.00 - 4.50
Glaubers salt, bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.20 - 1.40
Glycerine, c.p., drums, extra	lb.	.27½-.....	.27 -.....	.19 - .19½
Lead:				
White, basic carbonate, dry, casks	lb.	.10½-.....	.10¾-.....	.10½-.....
White, basic sulphate, sck	lb.	.09½-.....	.10 -.....	.10½-.....
Red, dry, sck	lb.	.12 -.....	.12½-.....	.12½-.....
Lead acetate, white crys., bbl	lb.	.14½- .15	.14½- .15	.15½-.....
Lead arsenate, powd., bbl	lb.	.14 - .15	.14 - .15	.13 - .14
Lime, chem., bulk	ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk	lb.	.11½-.....	.11½-.....	.12½-.....
Lithopone, bags	lb.	.05½- .06	.05½- .06	.06 - .06½
Magnesium carb., tech., bags	lb.	.06 - .06½	.06½- .06½	.06½- .07
Methanol, 95%, dr	gal.	.55 - .58	.57 - .62	.65 - .68
97%, dr	gal.	.57 - .62	.59 - .64	.67 - .69
Nickel salt, double, bbl	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk	lb.	.14 -.....	.14 -.....	.16½-.....
Phosphorus, red, cases	lb.	.65 - .68	.68 - .70	.70 - .75
Yellow, cases	lb.	.33 - .34	.34 - .36	.37½- .40
Potassium biehromate, casks	lb.	.08½- .08½	.08½- .08½	.08½- .08½
Carbonate, 80-85%, calc., csk	lb	.05½- .06	.06 -.....	.06 - .06½
Chlorate, powd	lb.	.08½- .09	.08½- .09	.07½- .08
Cyanide, cs	lb.	.55 - .57	.55 - .58	.47 - .62
First sorts, csk	lb.	$0.09 -$0.09½	$0.08½-$0.09	$0.08½-$0.08½
Hydroxide(c'stic potash) dr	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs	ton	34.90 -.....	34.90 -.....	34.55 -.....
Nitrate, bbl	lb.	.06 - .06½	.06½- .06¼	.06 - .07½
Permanganate, drums	lb.	.14½- .15	.14½- .15	.14½- .15
Prussiate, yellow, casks	lb.	.18½- .18¾	.18½- .18¾	.18½- .18¾
Sal ammoniac, white, casks	lb.	.06½- .06¾	.05¾- .06¾	.05¾- .06
Salsoda, bbl	cwt.	.95 - 1.00	1.10 - 1.20	1.20 - 1.40
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.38 -.....	1.38 -.....	1.38 -.....
Dense, bags	cwt.	1.45 - 1.55	1.45 - 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.10 -.....	3.10 -.....	3.10 -.....
Acetate, works, bbl	lb.	.04½- .05	.04½- .05	.05 - .05½
Bicarbonate, bbl	cwt.	2.00 - 2.25	2.00 - 2.25	1.75 - 2.00
Biehromate, casks	lb.	.06¼- .06½	.06¼- .06¾	.06½- .06¾
Bisulphate, bulk	ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl	lb.	.03½- .04	.03½- .04	.04½- .04½
Chlorate, kegs	lb.	.06½- .06½	.06½- .06½	.06½- .07
Chloride, tech	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl	lb.	.08½- .09	.08½- .09	.09 - .09½
Hyposulphite, bbl	lb.	2.50 - 3.00	2.65 - 3.00	.02½- .02½
Nitrate, bags	cwt.	2.57½-.....	2.63 -.....	2.55 -.....
Nitrite, casks	lb.	.08½- .09½	.08½- .09	.09 - .09½
Phosphate, dibasic, bbl	lb.	.03½- .03¾	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums	lb.	.10½- .10½	.10 - .10½	.10½- .10¼
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr	lb.	.03 - .03½	.03 - .03½	.02½- .03
Sulphite, crys., bbl	lb.	.03 - .03½	.02½- .03	.02½- .03
Strontium nitrate, bbl	lb.	.08½- .09	.09 - .10	.09½- .10
Sulphur, crude at mine, bulk	ton	19.00 -.....	19.00 -.....	14.00 -16.00
Chloride, dr	lb.	.05 - .05½	.05 - .05½	.04½- .05
Dioxide, cyl	lb.	.09 - .10	.09 - .10	.08½- .09
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.25 - 2.35
Tin bichloride, bbl	lb.	.17 -.....	.17½-.....	.15½-.....
Oxide, bbl	lb.	.64 -.....	.66 -.....	.58 -.....
Crystals, bbl	lb.	.41½-.....	.42½-.....	.38½-.....
Zinc chloride, gran., bbl	lb.	.07 - .07½	.07 - .08	.06 - .07½
Carbonate, bbl	lb.	.11 - .11½	.10½- .11	.12 - .14
Cyanide, dr	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl	lb.	.09 - .10	.10 - .10½	.08 - .08½
Zinc oxide, lead free, bag	lb.	.07½-.....	.07½-.....	.07½-.....
5% lead sulphate, bags	lb.	.07 -.....	.07 -.....	.06½-.....
Sulphate, bbl	cwt.	2.75 - 3.00	3.00 - 3.50	3.50 - 3.75

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl	lb.	$0.12½-$0.13	$0.13 -$0.14	$0.16½-$0.16½
Chinawood oil, bbl	lb.	.12½- .13	.12 - .12½	.12½- .13
Coconut oil, Ceylon, tanks, N. Y	lb.	.10½-.....	.10½-.....	.09½-.....
Corn oil crude, tanks, (f.o.b. mill)	lb.	.13 -.....	.10½-.....	.09½-.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.14 -.....	.12 -.....	.09½-.....
Linseed oil, raw, car lots, bbl	lb.	11.3 -.....	10.8 -.....	14.1 -
Palm, Lagos, casks	lb.	.09 - .09½	.08½- .9½	.09½- .09½
Niger, casks	lb.	.08½-.....	.08½-.....	.08½-.....
Palm Kernel, bbl	lb.	.10½-.....	.10 - .10½	.09½-.....
Peanut oil, crude, tanks(mill)	lb.	.12½-.....	.10 -.....	.10½-.....
Perilla, bbl	lb.	.....	.15 - .15½	.14½-.....
Rapeseed oil, refined, bbl	gal.	.89 - .90	.90 - .92	.98 - .99
Sesame, bbl	lb.	.....	.....-.....	.15 - .15½
Soya bean tank (f.o.b. Coast)	lb.	.10½-.....	.10 -.....	.10½-.....
Sulphur(olive foots), bbl	lb.	.08½-.....	.08¾-.....	.09½-.....
Cod, Newfoundland, bbl	gal.	.60 - .65	.64 - .66	.62 - .63
Menhaden, light pressed, bbl	gal.	.65 - .67	.69 - .71	.72 - .75
Crude, tanks(f.o.b. factory)	gal.	.47½- .50	.55 -.....	.55 - .58
Whale, crude, tanks	lb.	.....	.....	.08½-.....
Grease, yellow, loose	lb.	.08½-.....	.08½-.....	.08½- .09
Oleo stearine	lb.	.14 -.....	.12½- .13	.11 - .11½
Red oil, distilled, d.p. bbl	lb.	.10 - .10½	.11½- .11½	.11½- .11½
Tallow, extra, loose	lb.	.09 -.....	.08½-.....	.08½-.....

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.85 - .90	.90 - .95	.75 - .80
Alpha-naphthylamine, bbl	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.16 - .16½	.16 - .16½	.16 - .16½
Aniline salts, bbl	lb.	.22 - .24	.20 - .22	.20 - .22
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.65 - .70
Benzaldehyde, U.S.P., dr	lb.	1.15 - 1.25	1.30 - 1.35	1.50 -.....
Benzidine base, bbl	lb.	.72 - .74	.72 - .75	.78 - .80
Benzoic acid, U.S.P., kgs	lb.	.58 - .60	.56 - .60	.75 - .85
Benzyl chloride, tech, dr	lb.	.25 - .26	.25 - .26	.35 - .36
Benzol, 90%, tanks, works	gal.	.25 - .28	.25 - .28	.23 - .24
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.24 - .25
Cresol, U.S.P., dr	lb.	.18 - .20	.18 - .20	.23 - .25
Cresylic acid, 97%, dr., wks	gal.	.60 - .65	.63 - .71	.59 - .62
Diethylaniline, dr	lb.	.58 - .60	.58 - .60	.59 - .61
Dinitrophenol, bbl	lb.	.31 - .35	.30 - .33	.35 - .38
Dinitrotoluen, bbl	lb.	.17 - .18	.16 - .17	.18 - .20
Dip oil, 25% dr	gal.	.28 - .30	.28 - .30	.26 - .28
Diphenylamine, bbl	lb.	.45 - .47	.48 - .50	.48 - .50
H-acid, bbl	lb.	.63 - .65	.68 - .72	.70 - .74

Coal-Tar Products—Continued

	Current Price	Last Month	Last Year
Naphthalene, flake, bbl. . . . lb.	$0.05¼–$0.06	$0.05¼–$0.06	$0.05 –$0.05½
Nitrobenzene, dr. . . . lb.	.09 – .10	.09½– .10	.09 – .10
Para-nitraniline, bbl. . . . lb.	.50 – .53	.50 – .53	.65 – .67
Para-nitrotoluine, bbl. . . . lb.	.28 – .32	.30 – .35	.40 – .42
Phenol, U.S.P., drums. . . . lb.	.22 – .24	.22 – .24	.23 – .25
Picric acid, bbl. . . . lb.	.30 – .40	.30 – .40	.20 – .22
Pyridine, dr. . . . lb.	4.50 –. . . .	4.75 –. . . .	4.10 – 4.20
R-salt, bbl. . . . lb.	.47 – .50	.40 – .44	.50 – .55
Resorcinal, tech, kegs. . . . lb.	1.30 – 1.35	1.35 – 1.40	1.30 – 1.40
Salicylic acid, tech., bbl. . . . lb.	.30 – .32	.33 – .34	.32 – .33
Solvent naphtha, w.w.,tanks.gal.	.35 –. . . .	.35 –. . . .	.24 – .25
Tolidine, bbl. . . . lb.	.90 – .95	.95 – .96	1.00– 1.05
Toluene, tanks, works. . . . gal.	.35 –. . . .	.35 –. . . .	.26 –. . . .
Xylene, com., tanks . . gal.	.36 – .41	.36 – .41	.24 – .26

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl. . . . ton	$23.00–$25.00	$17.00–$17.50	$17.00–$17.50
Casein, tech., bbl. . . . lb.	.16½– .18½	.16½– .18½	.13 – .14
China clay, powd., f.o.b. Va.ton	10.00 –20.00	10.00 –20.00	12.00 –15.00
Imported, powd. . . . ton	45.00 –50.00	45.00 –50.00	45.00 –50.00
Dry colors:			
Carbon gas, black (wks.) . lb.	.08 – .08½	.08 – .08½	.06½– .08
Prussian blue, bbl. . . . lb.	.32 – .33	.32 – .34	.35 – .37
Ultramine blue, bbl. . . . lb.	.08 – .35	.08 – .35	.08 – .35
Chrome green, bbl. . . . lb.	.28 – .30	.28 – .30	.27 – .29
Carmine red, tins. . . . lb.	5.00 – 5.10	5.00 – 5.10	4.25 – 4.50
Para toner. . . . lb.	.80 – .90	.90 – .95	.95 – 1.00
Vermilion, English, bbl. . . lb.	1.45 – 1.50	1.40 – 1.45	1.40 – 1.45
Chrome yellow, C. P., bbl.lb.	.17½– .18	.17½– .18	.18½– .19
Feldspar, No. 1 (f.o.b. N. C.)ton	6.00 – 6.50	6.00 – 6.50	6.50 – 7.00
Graphite, Ceylon, lump, bbl lb.	.08½– .09	.08½– .09	.07 – .07½
Gum copal, Congo, bags. . . . lb.	.09½– .10	.09½– .10	.08 – .10
Manila, bags. . . . lb.	.15 – .18	.14 – .16	.14 – .16
Damar, Batavia, cases. . . . lb.	.25 – .25½	.25 – .26	.28½– .28½
Kauri, No. 1 cases. . . . lb.	.55 – .57	.57 – .65	.58 – .62
Kieselguhr (f.o.b. N. Y.). . . . ton	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc. . . . ton	40.00 –45.00	35.00 –42.00	35.00 –40.00
Pumice stone, lump, bbl. . . . lb.	.05 – .07	.04½– .08	.05 – .05½
Imported, casks. . . . lb.	.03 – .40	.03 – .40	.03 – .35
Rosin, H. . . . bbl.	13.00 –. . . .	12.50 –. . . .	8.40 – 8.50
Turpentine . . . gal.	.85 –. . . .	.88 –. . . .	.94 –. . . .
Shellac, orange, fine, bags. . . lb.	.29 – .30	.29 – .30	.62 – .65
Bleached, bonedry, bags. . lb.	.33 – .35	.33 – .35	.67 – .69
T. N. bags. . . . lb.	.26 – .27	.26 – .27	.58 – .59
Soapstone (f.o.b. Vt.), bags. . ton	10.00 –12.00	9.50 –10.00	7.50 – 8.00
Talc, 200 mesh (f.o.b. Vt.). . . ton	11.00 –. . . .	11.00 –. . . .	10.50 –. . . .
200 mesh (f.o.b. Ga.) . . . . ton	7.50 –10.00	7.50 –10.00	8.00 –12.00
325 mesh (f.o.b. N. Y.). . . . ton	14.75 –. . . .	14.75 –. . . .	14.75 –. . . .
Wax, Bayberry, bbl. . . . lb.	.20 – .21	.20 – .22	.21 – .21½
Beeswax, ref., light. . . . lb.	.46 – .47	.44 – .45	.38 – .39
Candelilla, bags. . . . lb.	.36 – .37	.32 – .33	.32 – .33
Carnauba, No. 1, bags. . . . lb.	.48 – .50	.48 – .49	.37 – .38
Paraffine, crude 105-110 m.p. . . . lb.	.05½– .06	.06 – .06½	.06½–. . . .

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%. . . . ton	$200.00–. . . .	$200.00–. . . .	$200.00–. . . .
Ferrochromium, 1-2%. . . . lb.	.23– .25	.23– .35	.24–. . . .
Ferromanganese, 78-82%. . . ton	88.00–90.00	90.00–. . . .	115.00–. . . .
Spiegeleisen, 19-21%. . . . ton	33.00–34.00	33.00–34.00	32.00–. . . .
Ferrosilicon, 10-12%. . . . ton	33.00–38.00	33.00–38.00	39.50–43.00
Ferrotungsten, 70-80%. . . . lb.	1.05– 1.10	1.10– 1.15	.90– . . .
Ferro-uranium, 35-50%. . . . lb.	4.50–. . . .	4.50–. . . .	4.50–. . . .
Ferrovanadium, 30-40%. . . . lb.	3.25– 4.00	3.25– 4.00	3.25– 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic. . . . lb.	$0.13⅜–. . . .	$0.14⅛–$0.14¼	$0.14⅛–$0.15¼
Aluminum, 96-99%. . . . lb.	.27 – .28	.27 – .28	.27 – .28
Antimony, Chin. and Jap. . . lb.	.19½– .23	.19½– .23	.20½–. . . .
Nickel, 99%. . . . lb.	.35 –. . . .	.34 – . . .	.31 – .32
Monel metal, blocks. . . . lb.	.32 – .33	.32 – .33	.32 – .33
Tin, 5-ton lots, Straits. . . . lb.	.59⅛–. . . .	.62½–. . . .	.57½–. . . .
Lead, New York, spot. . . . lb.	7.80 –. . . .	8.20 –. . . .	.09½–. . . .
Zinc, New York, spot. . . . lb.	7.45 –. . . .	.08½–. . . .	.07½–. . . .
Silver, commercial. . . . oz.	.65⅛–. . . .	.67 –. . . .	.63½–. . . .
Cadmium . . . lb.	.60 –. . . .	.60 –. . . .	.60 –. . . .
Bismuth, 500-lb. lots. . . . lb.	2.70 – 2.75	2.65 – 2.70	1.30 – 1.35
Cobalt. . . . lb.	2.50 –. . . .	2.50 –. . . .	2.50 – 3.00
Magnesium, ingots, 99%. . . . lb.	.75 – .80	1.00 –. . . .	.90 – .95
Platinum, ref. . . . oz.	105.00–. . . .	112.00–. . . .	117.00–. . . .
Palladium, ref. . . . oz.	78.00– 82.00	87.50– 88.00	78.00–. . . .
Mercury, flask. . . . 75 lb.	91.25–. . . .	91.00–	79.00–80.00
Tungsten powder. . . . lb.	1.18– 1.20	1.20–. . . .	.95– 1.00

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks. . . . ton	$5.50– $8.50	$5.50– $8.50	$5.50– $8.75
Chrome ore, c.f. post. . . . ton	21.00– 24.00	21.00– 24.00	18.50– 24.00
Coke, fdry., f.o.b. ovens. . . . ton	3.75– 4.25	3.75– 4.25	4.75– 5.00
Fluorspar, gravel, f.o.b. Ill. . . ton	18.00–. . . .	18.00–. . . .	17.50– 18.50
Ilmenite, 52% TiO_2, Va. . . . lb.	.0 ½–. . . .	.01½–. . . .	.01½–. . . .
Manganese ore, 50% Mn., c.i.f. Atlantic Ports. . . . unit	.4 – .42	.40 – .42	.42 – .43
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y. . . . lb.	.55 – .70	.55 – .70	.60– .70
Monazite, 6% of ThO_2. . . . ton	120.00–. . . .	120.00–. . . .	120.00–. . . .
Pyrites, Span. fines, c.i.f. . . . unit	.13½–. . . .	.13½–. . . .	.11½– .12
Rutile, 94-96% TiO_2. . . . lb.	.12 – .15	.12 – .15	.12 – .15
Tungsten, scheelite, 60% WO_3 and over. . . . unit	12.50 –13.00	12.50 –13.00	9.50 – 9.75
Vanadium ore, per lb. V_2O_5. . lb.	.30 – .35	.30 – .35	1.00 – 1.25
Zircon, 99%. . . . lb.	.03 –. . . .	.03 –. . . .	.06 – .07

Current Industrial Developments

New Construction and Machinery Requirements

New England

Conn., Bridgeport—H. Isaacs, 226 Oak St., manufacturers of hides and tallow, awarded contract for the construction of a 2 story, 60 x 75 ft. factory on Asylum St., to J. D'Agostino & Son, Warner Bldg. Estimated cost $40,000.

Conn., Middletown — Russell Mfg. Co., South Farms, manufacturers of fibre brake lining, awarded contract for the construction of a 1 story, 37 x 125 ft. web treating plant to Dennis O'Brien & Sons, River Rd. Estimated cost $10,000.

Me., Portland — Schlotter & Foss Co., plans the construction of a chemical plant. Estimated cost $50,000.

Mass., Boston — J. W. Allen & S. H. Whitely, Tremont Bldg., confectionery manufacturers, awarded contract for the construction of a 3 story, 40 x 70 ft. factory at 12 Minor St., to E. J. Farrell, 433 Tremont St. Estimated cost $40,000.

Mass., Boston—Goodyear Tire & Rubber Co., 61 Brookline Ave., is receiving bids for the construction of a 1 story, 67 x 150 ft. addition to plant. Densmore, LeClear & Robbins, Park Sq. Bldg., are architects.

Mass., Boston—Harvard University, c/o Stevens & Lee, 45 Newbury St., Archt., is having sketches made for the construction of a 2 story addition to anti-toxin laboratory.

Mass., Cambridge (Boston P. O.)—Lever Bros. Co., 164 Broadway, manufacturers of glycerin and soap, awarded contract for the construction of a 4 story addition to plant at Broadway and Burleigh St., to W. H. Whitcomb Construction Co., 6 Beacon St., Boston. Estimated cost $40,000 to $50,000.

Mass., Springfield—Kibbe Candy Co., Harrison Ave., plans the construction of a factory and office building on Berkshire Ave. Estimated cost $250,000.

Mass., Watertown (Boston P. O.)—Hood Rubber Co., Nichols Ave., awarded contract for the construction of a 1 story, 100 x 380 ft. addition to factory on Pine St. to Aberthaw Co., 80 Federal St., Boston. Estimated cost $75,000.

Mass., Winchester—J. O. Whitten Co., glue manufacturers, is receiving bids for the construction of a 2 story, 25 x 160 ft. addition to plant. Estimated cost $50,000. J. A. Bigelow, 94 Dudley St., Brookline, is architect.

Mass., Winchester—Winchester Gelatine Co., E. A. Perkins, is having plans prepared for the construction of a 1 story addition to factory on Cross St. Estimated cost $40,000. Private plans.

R. I., Providence—J. C. Goff Co., 31 Point St., manufacturers of brick and lime, etc., awarded contract for the construction of a 1 story plant at Rawley St. and Narragansett Ave. to Rawley Construction Co., 260 Central Ave., Pawtucket. Estimated cost $40,000.

Middle Atlantic

Del., Wilmington — Tannin Corp., 1 Pershing Sq., New York, N. Y., manufacturers of natural tanning extracts, will build a plant at Marine Terminal, here. Estimated cost $1,000,000. Work will be done by separate contracts under the supervision of E. B. Carter, c/o owner, Engr.

Md., Baltimore — Griffith & Boyd Co., E. Griffith, Pres., 611 Keysey Bldg., plans to rebuild fertilizer plant at Clinton and Fourth Sts. destroyed by fire. Estimated cost $250,000. Architect and engineer not selected.

Md., Baltimore—Summers Fertilizer Co., J. E. Totman, Pres., Stock Exchange Bldg., plans to rebuild 3 story plant at Clinton St. and Fifth Ave. destroyed by fire. Estimated cost $300,000. A. N. Ingram, Stock Exchange Bldg., is architect and engineer.

N. J., Pompton Lakes—E. I. du Pont de Nemours & Co., Wilmington Del., awarded contract for the construction of a new fuse manufacturing plant here to F. Hartman, Charlottesville, Va. Estimated cost $175,000.

N. Y., Brooklyn—Hilo Varnish Co., Marcy Ave., awarded contract for the construction of a factory to W. P. McGarry Co., 292 Freeman St. Estimated cost $200,000.

N. Y., Buffalo—Federal Portland Cement Co., awarded contract for foundations for buildings and machinery together with slurry tanks for cement plant to E. P. Muntz, L. V. Terminal Bldg., silos and pack house to M. A. Long Co., 10 West Chase St., Baltimore, Md. and superstructure to Lackawanna Steel Construction Co., Walden Ave.

N. Y., Lackawanna — Federal Portland Cement Co., 1082 Elliott Sq. Bldg., Buffalo, is receiving bids for the construction of a 1 and 4 story plant on Hamburg Rd., here. Estimated cost $2,000,000. Allis-Chalmers, West Allis St., Milwaukee, Wis., is engineer.

N. Y., New York—New York University, University Heights, awarded contract for the construction of a 4 story chemistry building to Saxton-Gerrard Co., Inc., 19 West 44th St. Estimated cost $750,000.

Pa., Butler—Standard Plate Glass Co., First National Bank Bldg., Pittsburgh, plans to rebuild portion of silica plant here recently destroyed by fire. Loss is estimated at $100,000.

Pa., Universal—Universal Portland Cement Co., 210 La Salle St., Chicago, Ill., plans the construction of a 1 story, 90 x 460 ft. addition to plant. Estimated cost $1,000,000. Private plans.

Pa., White Haven—Lehigh Chemical Co., White Haven, recently incorporated at $500,000 to manufacture sulphur dioxide and make chemical fertilizers, is in the market for tanks, sheet lead, boilers, machinery, etc.

South

Ga., Fort Benning—Constructing Quartermaster, War Dept., Washington, D. C., will soon award contract for the construction of a 39 x 72 ft. laboratory for hospital here.

Ky., Covington — Michaels Art Bronze Co., Scott St., awarded contract for the construction of a 4 story, 60 x 60 ft. factory to B. T. Wisenall, Crescent St. Estimated cost $40,000.

La., Lake Charles—Massoit Mfg. Co., 134 Pocasset St., Fall River, Mass., plans the construction of a plant for the manufacture of cellulose from rice hulls on the Calcasieu River here. Estimated cost $200,000.

N. C., Sanford—Sanford Shale & Brick Co., F. R. Snipers, plans the construction of a plant near here. Estimated cost $100,000.

Tenn., Cowan—Cumberland Portland Cement Co., W. V. Davidson, Pres., awarded contract for the construction of a 2,000 bbl. white and gray cement plant to Allis-Chalmers Mfg. Co., West Allis St., Milwaukee, Wis.

Tenn., Erwin — Southern Potteries Co., plans extensions to clay working plant including 65 x 540 ft. kilns. Estimated cost $40,000. Private plans. Owner will purchase new equipment, to cost $15,000.

Middle West

Ill., Chicago—The James H. Boye Mfg. Co., 412 Orleans St., Chicago, manufacturers of brass and bronze castings, etc., awarded contract for the construction of a 1 story, 145 x 160 ft. plant to H. Wolter, 6138 Kenmore Ave. Estimated cost $80,000.

Ill., East St. Louis—Darling & Co., Missouri Ave. and Alton St., awarded contract for the construction of a 1 story, 120 x 136 ft. addition to fertilizer plant, to The Austin Co., 169 North La Salle St., Chicago. Estimated cost $65,000.

Ill., La Salle—Central State Portland Cement Co., 111 West Monroe St., Chicago, is having plans prepared for the construction of a plant, initial annual capacity 1,000,000 bbl., here. Estimated cost $3,000,000. Cowham Engineering Co., 111 West Monroe St., Chicago, is engineer.

Ill., Morris—Morris Paper Mill Co. M. F. Leopold, Pres., 111 West Washington St., Chicago, will soon award contract for the construction of a 1 story warehouse on Washington St. here. Estimated cost $50,000. C. A. Chapman, 9 South Clinton St., Chicago, is architect and engineer.

Ill., Peoria—Commercial Solvents Corp., 601 Parkside Ave., awarded contract for the construction of a 1 and 2 story chemical laboratory on Durst St. to Stone & Webster Inc., 14 Milk St., Boston, Mass. Estimated cost $1,000,000.

Ill., Villa Park—Wander Co., manufacturers of ovaltine, awarded contract for the construction of a 4 story addition to factory to W. Youngberg, Elmhurst. Estimated cost $200,000.

Ind., Indianapolis—Bd. of School Commissioners, N. M. Frazer, Dir., is having sketches made for the construction of a 3 story school including laboratories, etc. Estimated cost $1,000,000. Kopf & Deery, 403 Indian Pythian Bldg., are architects.

Mich., Detroit—Detroit Stove Works, East Jefferson Ave., awarded contract for the construction of a 2 story, 85 x 100 ft. enameling plant in connection with stove factory to Malow-Barry Co., 2631 Woodward Ave.

Mich., Detroit—Ditzler Color Co., 40 West Baltimore Ave., plans the construction of a 2 story, 60 x 190 ft. paint factory at Detroit Terminal R.R. and Chicago Blvd. Weston & Ellington, 1507 Stroh Bldg., are engineers. Equipment for the manufacture of color varnishes and paints for automobiles, also equipment for mixing room will be required.

Mich., Watervliet—Watervliet Paper Co., W. M. Loveland, Pres., Pratt Bldg., Kalamazoo, awarded contract for the construction of a 2 story, 100 x 160 ft. addition to paper mill here to O. F. Miller Construction Co., Pratt Bldg., Kalamazoo. Estimated cost $50,000.

O., Canton—Damp-Proof Tile Co., manufacturers of damp-proof tile, recently organized, plans the construction of a factory on Whipple Rd. Estimated cost $50,000. Owner is in the market for clay making machinery.

O., Canton—Stark Clay Products Co., plans the construction of a fireproofing and clay products plant. Machinery will be required.

O., Cleveland—City, W. R. Hopkins, Mgr., will receive bids until June 23 for the construction of a 2 story, 51 x 170 ft. diagnostic laboratory on Scranton Rd. Estimated cost $300,000. A. Garfield, National City Bldg., is architect.

O., Cleveland — Rickersberg Brass Co., East 37th St. and Perkins Ave., awarded contract for the construction of a 1 story, 150 x 200 ft. plant to Van Blarcom Co., National City Bank Bldg.

O., Cleveland—The Willard Storage Battery Co., c/o P. H. Voth, Const. Dept., East 131st St. and St. Clair Ave., had plans prepared for the construction of a 3 story, 64 x 122 ft. acid storage building. Estimated cost $110,000. Private plans.

O., Dayton—United States Army, Capt. George, Const. Quartermaster, Wright Field, will receive bids about June 21 for the construction of a 2 story, 53 x 520 ft. administration and 1 story, 300 x 480 ft. laboratory buildings on Wilbur Wright Aviation Field.

Wis., Owen—Oatman Condensed Milk Co., Dundee, awarded contract for the construction of a 1 story, 42 x 192 and 32 x 69 ft. plant here to W. F. Weaver Construction Co., Owen. Estimated cost $40,000.

Wis., Rhinelander — Daniels Mfg. Co., awarded contract for the construction of a 1 story, 62 x 110 ft. addition to paper mill to L. A. DeGuere, Mead-Witter Blk., Wisconsin Rapids. Estimated cost $40,000. Special machinery will be installed.

West of Mississippi

Ark., Smackover—Simms Oil Co., Magnolia Bldg., Dallas, Tex., will build an oil refinery group to run 2,500 to 3,000 bbl. crude to gasoline, fuel and road oil, two 1,000 bbl. cracking units with pipe stills, boiler plants and auxiliary equipment. Work will be done under the supervision of F. Gardner, c/o owner, Ch. Engr.

Mo., Kansas City—J. Breckline, 63rd and High Drive, awarded contract for the construction of a 1 story, 24 x 115 ft. chemical plant at 1605 Locust St., to C. E. Ennis, 1216 East Gillham Rd. Estimated cost $40,000.

Mo., St. Louis—Asbestos Shingle Slate & Sheeting Co., Ambler, Pa., has acquired a 20 acre site and plans the construction of a plant at Burlington St. and Bellefontaine Rd., here. Private plans.

Texas—Texas Salt Co., c/o G. Leland, Mgr., Houston, will build a plant 150 ton per hour capacity, 14 miles south of Houston by day labor. Estimated cost $150,000. Private plans.

Tex., Abilene—Abilene Cotton Oil Co., c/o J. C. Jones, Mgr. and L. Fleming, Anderson-Clayton Cotton Co., Houston, awarded contract for the construction of a 2 story, 42 x 368 ft. cotton oil mill here to J. R. Horn & Sons, Abilene. Estimated cost $400,000.

Tex., Alamo—Deer Creek Stone Quarries, Topeka, Kan., has tentative plans for the construction of a cement block plant here. Estimated cost $60,000. Private plans. Owner is in the market for machinery.

Tex., Alvin—Magnolia Fig Products Co. Inc., M. M. Elfers, Pres., has tentative plans for the construction of a fig preserving plant in connection with candy factory. New machinery to increase the capacity from 250 to 1,000 lb. will be installed. Estimated cost $42,000. Engineer not selected.

Tex., Breckenridge—Roeser-Pendleton Co. plans the construction of a new gasoline refinery, initial capacity 12,000 gal. daily. Estimated cost including equipment $100,000.

Tex., Cisco—Phillips Petroleum Co., is having plans prepared for the construction of a gasoline plant. Estimated cost $250,000. Private plans.

Tex., D'Hanis—D'Hanis Brick & Tile Co., 710 Builders Exchange Bldg., San Antonio, will build 15 to 20 brick kilns here. Estimated cost $125,000. Private plans.

Tex., Hialeah—Martin Cement Products Co., West 23rd St., has plans under way on the construction of a 1 story mill. Estimated cost including equipment $30,000. Brick machinery, tile forming machinery, rock crusher, etc. will be required.

Tex., San Antonio—G. A. Duerler Mfg. Co., 28 West Commerce St., candy manufacturers, awarded contract for the construction of a 6 story factory at Camp St. near Southern Pacific R.R. to E. Oeffinger, Builders Exchange Bldg. $153,000.

Tex., Texarkana—Bd. of Education, C. C. Bounds, Pres., plans the construction of a 2 story junior college building including laboratory. Witt, Siebert & Halsey, 807 Texarkana National Bank Bldg., are architects.

Far West

Calif., San Francisco—Royal Tallow & Soap Co., Davidson St., is considering rebuilding portion of plant recently destroyed by fire. Loss is estimated at $100,000.

Calif., San Pablo—Standard Sanitary Mfg. Co., 10th and Brannan Sts., San Francisco, manufacturers of plumbing fixtures, is having plans prepared for the construction of a 1 and 3 story, 350 x 1,250 ft. factory here. Estimated cost $500,000. G. W. Kelham, Sharon Bldg., San Francisco, is architect. H. J. Brunnier, Sharon Bldg., San Francisco, is engineer.

Ore., Salem—Oregon Pulp & Paper Co., F. W. Leadbetter, Pres., awarded contract for the construction of two 2 story, additions to plant for machine and web rooms, to Cuyler Van Patten. Estimated cost $190,000.

Wash., Bellingham—The Pacific Coast Paper Mills plan the construction of a mill for the manufacture of tissue paper from pulp. Estimated cost $150,000.

Wash., Shelton—Rainier Pulp & Paper Co., affiliated with the Washington Pulp & Paper Co., Port Angeles, had preliminary plans prepared for the construction of a new sulphite pulp mill here. Estimated cost $200,000. V. D. Simons, 431 North Michigan Ave., Chicago, Ill., is engineer.

Canada

Ont., Cornwell—Canadian Cellulose Co., Ltd., awarded contract for the construction of a soda pulp mill to the Belmont Co., Ltd., 37 Belmont St., Montreal. Estimated cost $100,000.

Ont., Fort William—The Fort William Paper Co., plans the construction of a 75 ton sulphite pulp mill to double the capacity of plant. Estimated cost $2,000,000. Equipment will be required.

Ont., Petrolia—Peninsula Sugar Co., L. W. Lawson, Pres., is having plans prepared for the construction of a factory. Estimated cost $1,000,000.

Ont., Sault Ste. Marie—Spanish River Pulp & Paper Co., awarded contract for the installation of twelve 1,200 hp. water turbines for pulp grinders, horizontal units to Wm. Hamilton Co., Ltd., Peterborough.

Ont., Thorold—Superior Paper Co., Ormond St., is in the market for complete equipment for plant. Estimated cost $100,000.

Ont., Tillsonburg—Regal Oil Corp., W. B. Brooks, Pres. and Gen. Mgr., 704 Confederation Life Bldg., Toronto, awarded contract for foundations for 14 buildings, machinery and tanks for an oil refinery here, to Orr & Clark, 121 Carlaw Ave., Toronto. Estimated cost $75,000. Total estimated cost $250,000. Contracts for superstructures including laboratories will be awarded later.

Ont., Toronto—Bd. of Education, W. W. Pearse, Secy., 155 College St., will receive bids until June 23, for chemicals and chemical laboratory apparatus.

Ont., Toronto—The Highland Scotch Distillers, Ltd., c/o J. A. Currie, M.P.P., is in the market for complete machinery and equipment for new plant at Port Colborne.

Ont., Toronto—Wm. Gore, Confederation Life Bldg., and A. G. Acres, Niagara Falls, Consult. Engr., have submitted report for new duplicate waterworks system. The principal features include a filtration plant, chlorination equipment, etc., at Victoria Park. Total estimated cost $14,317,000.

Ont., Trenton—Hinde & Dauche Paper Co., 43 Hann St., Toronto, manufacturers of corrugated paper, awarded contract for the construction of a 1 and 2 story strawboard mill here to J. J. McNab. Estimated cost $360,000 to $450,000. Paper making machinery will be required.

Que., Carleton — Robrichaud & Bugold, are in the market for machinery and equipment for new plant for scallop canning.

Que., Ste. Anne De Beaupre—Ste. Anne Power & Paper Co., J. T. Donohue, Pres., Murray Bay, awarded contract for the construction of a paper mill, 250 ton daily capacity, to William L. Bishop, Ltd., 10 Cathcart St., Montreal. Estimated total cost approximately $5,000,000.

JUN 17 1926

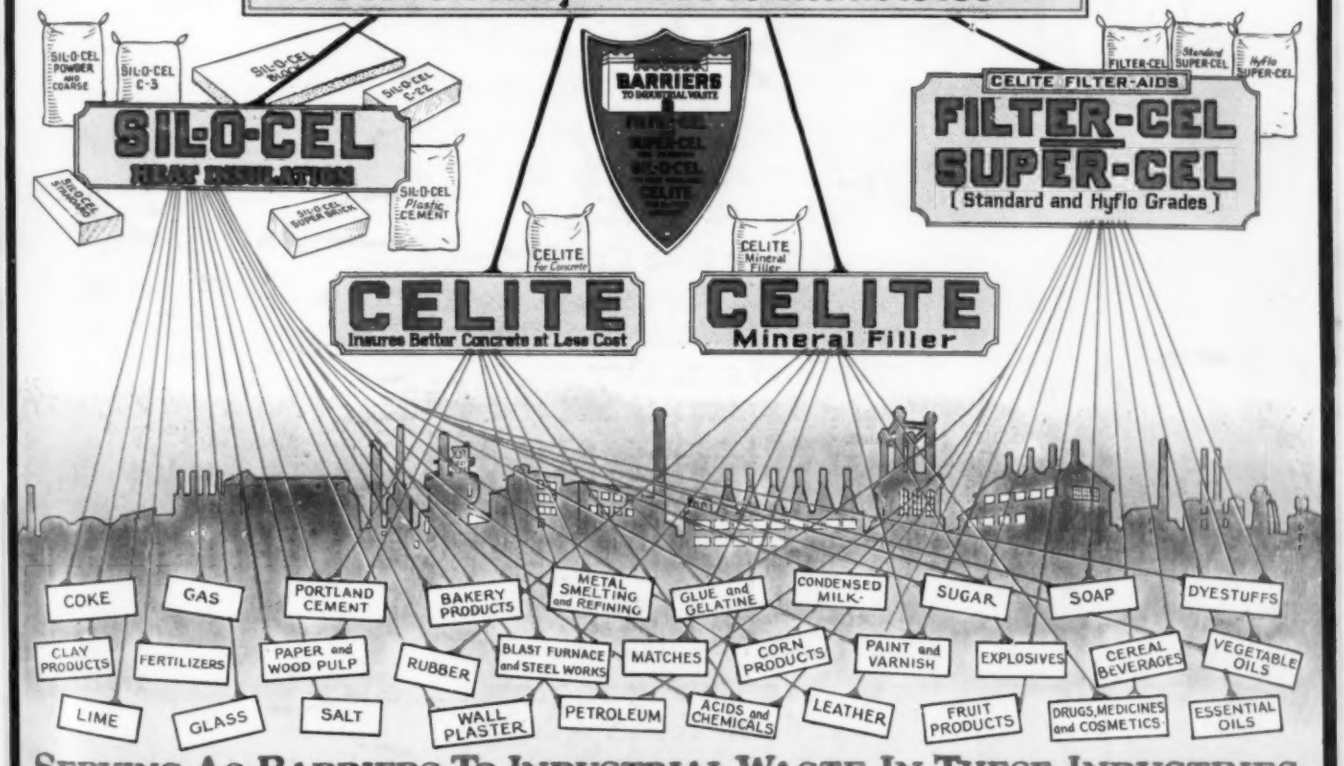
McGraw-Hill Publishing Company, Inc. June 1926 Price Thirty-five Cents per Copy

CHEMICAL & METALLURGICAL ENGINEERING

For men engaged in production of heavy and fine chemicals, electrochemicals, cement, lime, ceramics, cellulose products, coal products, explosives, food products, fertilizers, glass, leather, paint and varnish, oils, pulp and paper, petroleum products, rubber, soap, sugar and other chemical engineering products

CELITE and the PROCESS INDUSTRIES

THE SILICEOUS MINERAL CELITE Is Manufactured Into Specific Products to Serve Many Process Industries



SERVING AS BARRIERS TO INDUSTRIAL WASTE IN THESE INDUSTRIES

THE MINERAL CELITE plays a part in the manufacture of many different commodities that are in daily use by virtually every person in the country.

Its production and distribution in its various forms is only the first phase of the service rendered by the Celite Products Company. Toward the design of heated equipment Celite engineers have worked out every essential detail of insulated construction. They have developed efficient processes for the clarification of practically all types of liquors. These specialists are daily co-operating in the selection and use of light abrasives and mineral fillers, and in the solution of problems pertaining to the proportioning and placing of concrete.

In its broadest sense Celite service is always at the command of engineers and plant executives, at any office of the Company.

CELITE PRODUCTS COMPANY

New York · 11 Broadway
Chicago · 53 W. Jackson Blvd
Los Angeles 1320 So. Hope St.
San Francisco · 140 Spear St.
OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

Celite Products Limited
New Birks Building
Montreal · Quebec

Celite Products Corporation
147 Windsor House Westminster
London · England

AIR via Timken Bearings

A highly infallible air supply with utmost economy calls for Timken Tapered Roller Bearings.

They largely take the friction out of blower shaft mountings, conserving power. With their taper design and greater load area they are more than equal to the exceptionally heavy radial and thrust reactions of the fan.

With the Timken-made steel of Timken Bearings taking all the contact—the shaft takes no moving contact at all—longest life with most continuous perfect operation is assured.

Every ventilating engineer needs Timken data. Write.

THE TIMKEN ROLLER BEARING CO.
C A N T O N , O H I O

TIMKEN *Tapered Roller* BEARINGS

Vol. 33 No. 6

CHEMICAL & METALLURGICAL ENGINEERING

SIDNEY D. KIRKPATRICK
Associate Editor
GRAHAM L. MONTGOMERY
CHAPLIN TYLER
Assistant Editors

HENRY M. BATTERS
Market Editor
R. S. McBRIDE, Washington
Assistant Editor

H. C. PARMELEE, *Editor*

Chemical & Metallurgical Engineering is the successor to *Metallurgical & Chemical Engineering*, which, in turn, was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine*. The magazine was originally founded as *Electrochemical Industry*.

Contents, June, 1926

Making Alcohol-Ether Mixture in Cuba for Motor Fuel 332
By E. HUMBOLDT.

Comparison of Gas and Electricity for Industrial Heating 337
By R. C. GOSREAU.

Absolute Alcohol by Distillation 340
By H. GUINOT.

Automatic Control Improves and Simplifies an Industry 341
By S. D. KIRKPATRICK.

Artificial Wool Manufacture 345
By HANS DREXLER.

Testing Corrosion of Iron 346
By T. FUJIHARA.

Manufacture of Refined Corn Sugar 347
By LIONEL K. ARNOLD.

Economics of the Chlorine Industry 350
By D. A. PRITCHARD.

Indurating Wood with Sulphur 354
By WILLIAM H. KOBBÉ.

Corrosion Theories and Facts 357
By PEIRCE D. SCHENCK.

Electrodeposition of Rubber Suggests Many Industrials Applications 358
By FELIX A. ELLIOTT.

Low Temperature Carbonization and Steam Generation 360

Interchangeability of Oils and Fats in the Soap Industry 362

Plant Notebook 370
Large Saving Made by Using Mixed Flow Turbine—How One Plant Solved a Draft Problem—Aluminum Paint and Transformers—Diazo Compounds Cause Skin Disease—Method of Preventing Bridging in Chutes or Hoppers.

Equipment News 372
Resistance Welder—Rotary Pump—Small Hammer Mill—Skid Platform—Pneumatic Sweeper—Cylindrical Ball Mill—Electrical Equipment—Distant-Reading Recorder—Air Heater—Speed Reducer—Stoker—Vacuum Evaporator—Lined Pump—Motor Operated Valves—Catalogs.

News of the Industry 377
Washington News—Foreign Correspondence—Personals—Obituaries—Industrial Notes—Calendar.

Markets 385
Market Reviews—Business Graphs—Index Numbers—Prices—Construction News.

Editorials 329
Book Reviews 365
Correspondence 367
Technical Literature 368
Government Publications 369
Patents 376

While They Last!

MANY READERS have asked us for extra copies of the pictorial history of chemical engineering that featured the September Exposition number of *Chem. & Met.* You will probably recall the unusual collection of pen-and-ink drawings that were used to contrast early and recent practice in such unit processes as evaporation, drying, crushing and grinding and thickening and in such chemical engineering industries as the manufacture of acids, pulp and paper, soap, petroleum products, glass and ceramics.

TEACHERS of chemical engineering tell us that they found these graphic comparisons of modern mechanical equipment with primitive manual methods an instructive means of demonstrating the progress of technology. Certain readers found the entire set suitable for framing.

BELIEVING that there are others who might desire copies of this "Pageant of Progress" we have had a limited supply printed on antique stock in a convenient form for distribution. Upon request we shall be glad to mail a reasonable number of copies to any reader. They will be sent you with *Chem. & Met.'s* compliments. But the supply is limited, so: First come, first served!

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Avenue at 36th Street, NEW YORK, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

WASHINGTON, Colorado Building
CHICAGO, 7 South Dearborn St.
PHILADELPHIA, 16th and Parkway
CLEVELAND, Guardian Building
ST. LOUIS, Star Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

Member Audit Bureau of Circulations

Cable Address: "Machinist, N. Y."

Publishers of
Engineering News-Record — American Machinist
Power — Chemical and Metallurgical Engineering
Coal Age — Engineering and Mining Journal-Press
Ingeniería Internacional — Successful Methods
Bus Transportation — Electric Railway Journal
Electrical World — Electrical Merchandising
Radio Retailing — Industrial Engineer
Journal of Electricity
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

Number of Copies Printed This Issue, 12,900

The annual subscription rate is $3 in the United States, Canada, Mexico, Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba, Honduras, Nicaragua, Dominican Republic, Salvador, Peru, Colombia, Bolivia, Ecuador, Argentina, Panama, Brazil, Uruguay, Costa Rica, Guatemala, Paraguay, Chile, Haiti and Spain. Extra foreign postage in other countries $2 (total, $5, or 21 shillings). Single copy 35c. Change of address—When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before change takes place.

Copyright, 1926, by McGraw-Hill Publishing Company, Inc.

Published monthly. Entered as second-class matter July 13, 1918, at the Post Office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

Member Associated Business Papers, Inc.

Searchlight Section, 180-188; Professional Directory, 178-179; Ready Reference, 192-194-196-198; Alphabetical Index, 200

If you must use your blowpipe as a hammer

or leave it in the road to be smashed by the factory truck, pick up the pieces and send them to the nearest Oxweld apparatus repair station.

There are 21 Oxweld repair stations throughout the country. One of them is near you. Mail or express your blowpipe direct to this nearest station and it will be back in service before you know it, for a nominal charge.

Oxweld repair stations are factory supervised and give the same careful service that you would get from the factory direct. Saving time and money for our customers is our main reason for establishing them.

OXWELD ACETYLENE COMPANY

Chicago	Long Island City, N. Y.	San Francisco
3642 Jasper Place	Thompson Ave. & Orton St.	1050 Mission Street

OXWELD
Apparatus Repair Stations

Baltimore
Birmingham
Boston
Buffalo
Chicago
Cleveland
Denver
Detroit
Houston
Los Angeles
Minneapolis
Newark
Omaha
Philadelphia
Pittsburgh
Portland
St. Louis
Salt Lake City
San Francisco
Seattle
Tulsa

Oxweld

WELDING AND CUTTING APPARATUS

When is oxygen cheap?

CHEAPNESS is relative and depends entirely on how much material, quality and service you get for your money.

Linde Oxygen—for years industry's standard—is sold on a basis of ultimate economy. Linde service, which goes with Linde oxygen, is designed to give to every customer the latest and best information on the use of the oxy-acetylene process. Service men, engineers, consultants, research men, are constantly at work and always at your service to show the latest methods, new applications and greater economies in welding and cutting.

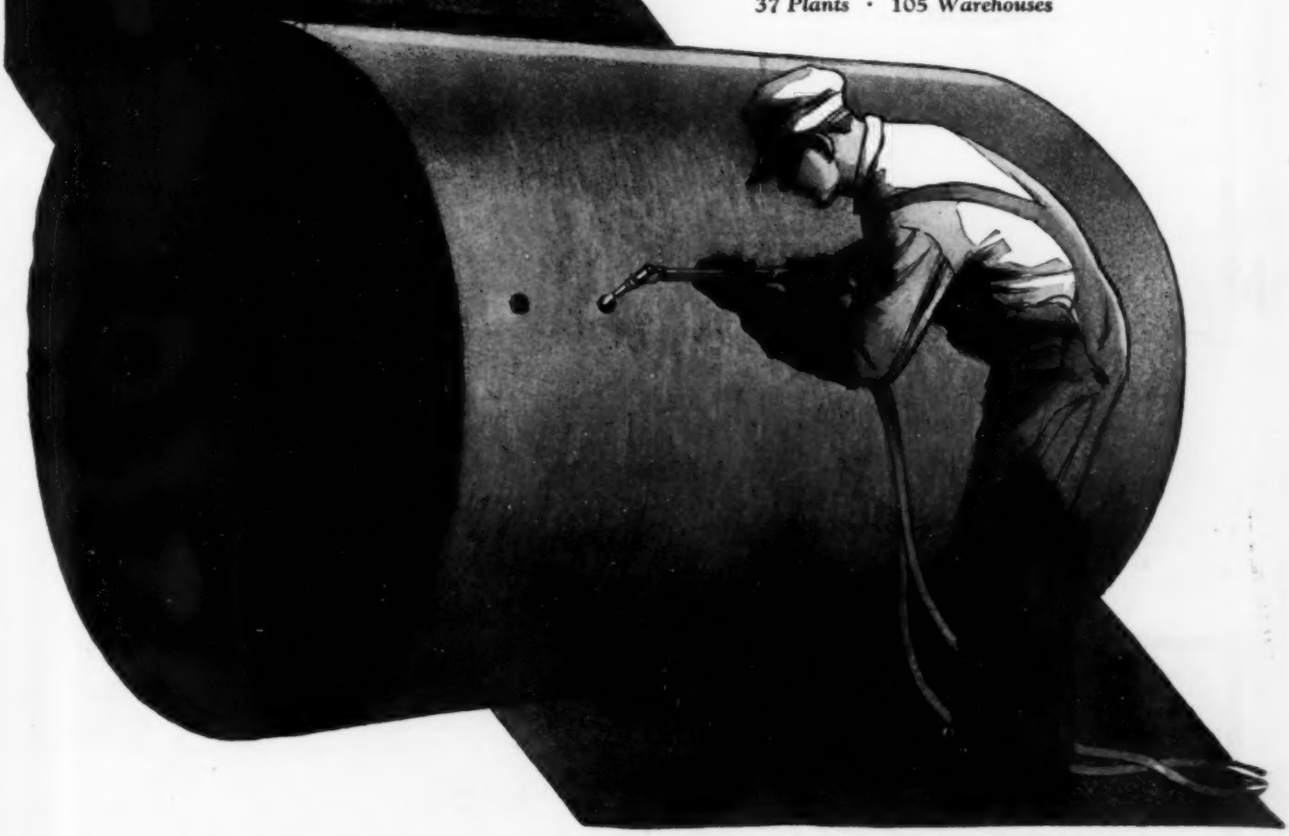
NOT ONLY can you build new tanks advantageously by welding, but old tanks that have given way on the bottom or on the crown can be repaired and reconditioned. Linde Methods tell you how to replace a bottom or a crown by the oxy-acetylene process and Linde engineers can give you suggestions even on design.

THE LINDE AIR PRODUCTS COMPANY

Manufacturers of oxygen, nitrogen, pyrogen, argon and neon
Producers of helium for scientific purposes

General Offices: Carbide and Carbon Building
30 East 42d Street, New York

37 *Plants* · 105 *Warehouses*



LINDE OXYGEN

The Ideal Ferrosilicon

In the manufacture of steel to rigid chemical specifications it is desirable to use ferrosilicon of uniform quality, furnished in clean, large lumps, low in impurities and free from disintegration.

ELECTROMET 50% ferrosilicon is made from selected materials to meet these conditions.

LARGE STOCKS are carried at all times to meet the immediate demands of our customers.

Sole Distributors
ELECTRO METALLURGICAL SALES CORPORATION
Carbide and Carbon Building, 30 E. 42d St., New York

Electromet Brand *Ferro-Alloys and Metals*

CHROMIUM

- High Carbon Ferrochrome (maximum 6% carbon)
- Low Carbon Ferrochrome (in grades, maximum 0.10% to maximum 2.00% carbon)
- Chromium Metal
- Chromium Copper
- Miscellaneous Chromium Alloys

MANGANESE

- Standard Ferromanganese 78 to 82%
- Low Carbon Ferromanganese
- Manganese Metal
- Manganese-Silicon
- Manganese-Copper
- Miscellaneous Manganese Alloys

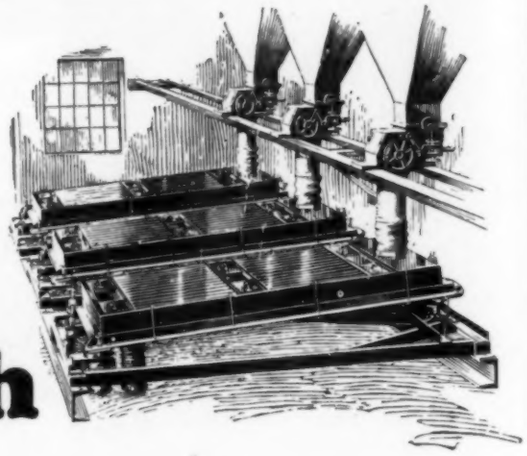
SILICON

- Ferrosilicon 15%
- Ferrosilicon 50%
- Ferrosilicon 75%
- Ferrosilicon 80 to 85%
- Ferrosilicon 90 to 95%
- Refined Silicon (minimum 97% silicon)
- Calcium-Silicon
- Silicon-Copper
- Manganese-Silicon
- Silico-Manganese
- Miscellaneous Silicon Alloys

ZIRCONIUM

- Silicon-Zirconium
- Nickel Zirconium
- Zirconium-Ferrosilicon

The TOLHURST Suspended Centrifugal is the practicable machine for most industrial requirements, meeting every demand for simplicity in operation and economy in time, labor and floor space.
The TOLHURST Suspended Centrifugal can be adapted to practically all chemical and industrial work and is arranged for direct motor, belted motor, countershaft or engine drive.
TOLHURST
REG. U. S. PAT. OFF.
CENTRIFUGALS
© T.M.W.
TOLHURST MACHINE WORKS
Established 1852
TROY, N. Y.
New York Office: 30 Church St.
Western Representative:
John S. Gage
8 So. Dearborn St.,
Chicago, Ill.
San Francisco Representative:
B. M. Pilhashy
Merchants Exchange Building
San Francisco, Cal.
Southern Representative:
Fred H. White
Independence Building
Charlotte, N. C.
Canadian Representative:
W. J. Westaway Co.
Westaway Bldg., Hamilton, Ont.
275 Craig West., Montreal, P.Q.
DESIGNED AND BUILT BY SPECIALISTS



No oversize goes through

BECAUSE the clothing on the nearly level Rotex screen is the size of the product desired. This is one of the important points of difference between the Rotex and the steeply inclined stationary type of screen which must employ screen openings almost twice the size of the desired product.

The advantage of this feature in promoting maximum screening efficiency is at once apparent. Oversize, some of which always goes through the larger openings necessitated by the steep incline of gravity screens, hasn't a chance of getting through the correctly sized aperture on the Rotex.

Then, too, on account of the nearly level position of the screen surface, Rotex may be counted upon to pass more per unit of screen area than other types of screens. We are glad to have Rotex screens tried out in comparison with other makes to prove this statement.

And,—don't overlook the fact that the Rotex Screen surface is being rapidly gyrated, and at the same time vibrated. In the Rotex mesh cleaning system large numbers of solid rubber balls are thrown forcibly against the under side of the screen, so that Rotex meshes stay open. Rotex Screens are not only efficient when started up, but continue to screen rapidly and accurately throughout the day.

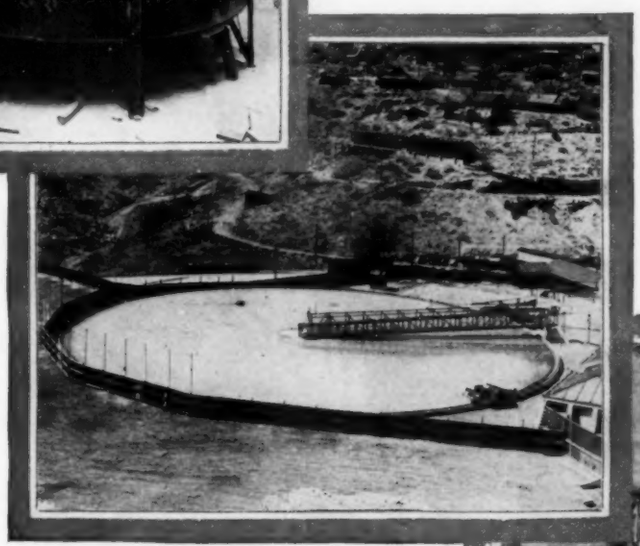
THE ORVILLE SIMPSON CO., 1252 KNOWLTON ST., CINCINNATI

ROTEX

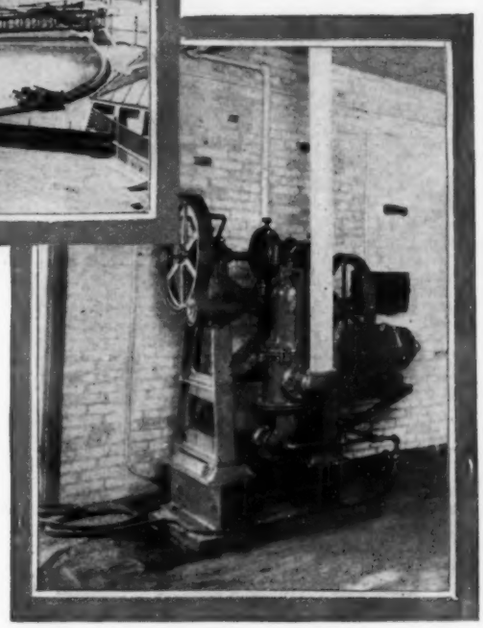
Dorr Bowl Classifier assembled in shops for inspection before shipment

DORRCO

"The Symbol of SERVICE"



A Dorr Traction Thickener in operation



A DORRCO Pressure Pump installation

—illustrating typical DORR units

If your plant operation involves classification, thickening, pumping, washing or agitation—let our engineers discuss with you the application of DORR equipment.

THE DORR COMPANY

ENGINEERS

247 PARK AVENUE NEW YORK CITY

DENVER LOS ANGELES CHICAGO WILKES-BARRE JOPLIN

THE DORR CO. LTD
16 South Street London E.C.2

DORR G. m.b.H.,
Joachimsthalerstr. 10, Berlin W.15

SOC. DORR ET CIE.
126, Rue de Provence Paris 8

INVESTIGATION TESTS DESIGN EQUIPMENT

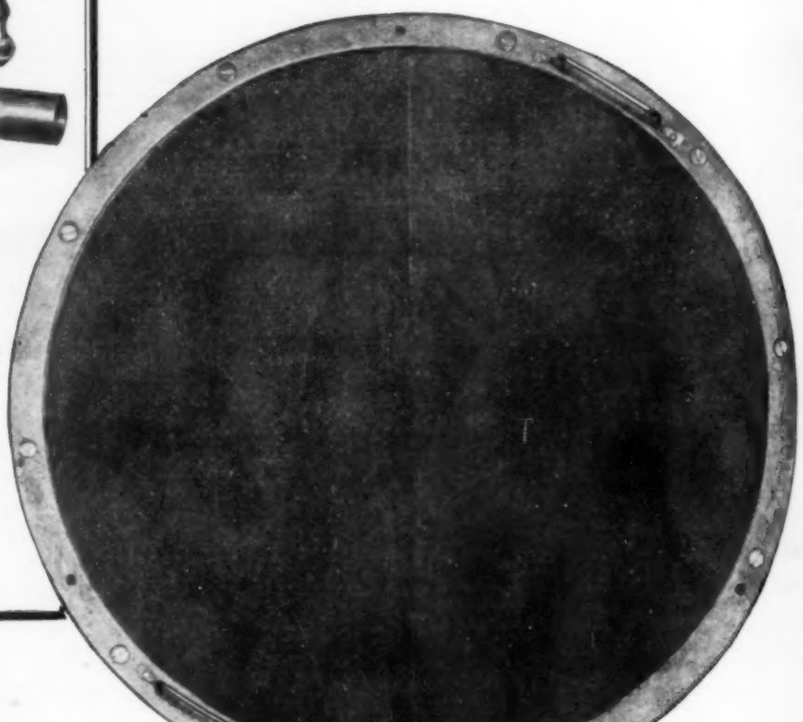
for screens that

for straining—

ENAMEL VARNISH SHELLAC
PAINT WOOD-STAIN CLAY MILK
and other materials

The Paint-Hog Electric Vibratory Strainer and Sifter is manufactured by the VIBRATING MACHINERY CO. INC., *of* CHICAGO, ILL., *and is equipped with Monel Metal wire cloth screen.*

This Monel Metal wire cloth
spite of



NEWARK WIRE CLOTH CO.'S *Monel Metal Screen — available in various mesh sizes — customarily used in Paint-Hog Electric Vibratory Strainers and Sifters.*

INCo
Monel

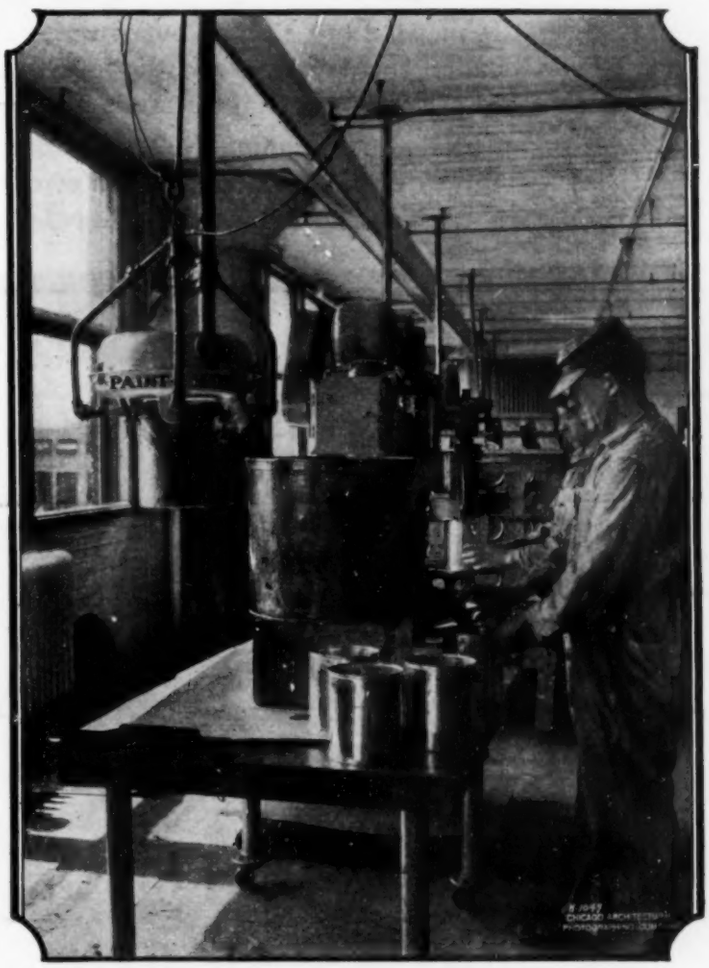
...jiggle and shake

...wire cloth has long life in ...e of continuous vibration and corrosive attacks

THE continuous jiggle and shake of vibratory screens wear out ordinary wire cloth in a very short time. But Monel Metal stands up under the scrape and rub of the erosive materials being screened. Its steel-like strength and toughness give longer life where "wear and tear" is most severe.

There are other advantages in Monel Metal. It will not rust and it resists corrosion. It is more easily cleaned. It safeguards the purity and color of the product screened.

Monel Metal is a Nickel-copper alloy of high Nickel content. It can be forged, welded, soldered, brazed, machined, etc. It is available in all commercial forms including tubing. In one of its many forms it will give economical service in YOUR plant. Why not let our engineers give you the benefit of their long experience and help you adapt Monel Metal to your needs?



Typical installation of Paint-Hog Electric Vibratory Sifters in the Illinois Paint Works Dept. of Sears, Roebuck & Co., Chicago, Ill.

SEND FOR "LIST B" OF MONEL METAL AND NICKEL LITERATURE

THE INTERNATIONAL NICKEL COMPANY

67 WALL STREET NEW YORK CITY

Monel Metal is a technically controlled Nickel-Copper alloy of high nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company. The name "Monel Metal" is a registered trade mark.

metal

The Greedy Hand of Waste

There is one factor that is of utmost importance to the manufacturer who puts out any bulk material in bags, sacks, cartons, packages, or other type of container—accurate weight.

Aside from all other considerations, a scale that is not accurate becomes, in the long run, a greedy hand of waste.

It may be but a small over-run here and another there; but at the end of the day, or week, the total excess weights may easily amount to a loss of material that runs to a heavy cost.

Automatic Weighing Machine Company scales unite extreme accuracy of weighing with speed of operation. The No. 515-A Automatic Sacking Scale, for instance, which is widely used by fertilizer

manufacturers, weighs and bags from four to six bags of material, one hundred twenty-five pound to two hundred pound weight, per minute, giving ninety percent balanced weights, and a variation for the remainder that will not exceed a maximum of one-tenth of one percent.

Other scales are made for various uses; all to similar degrees of accuracy. What is your weighing problem?

Automatic Weighing Machine Company

Division of

AMERICAN MACHINE & FOUNDRY CO., BROOKLYN, N. Y.

16 MONTHS LATER

11 Months—No Repairs
C-E Fin Furnace walls for the past 11 months have been subjected to severe performance at Hell Gate.
Extremely high boiler ratings have been carried continuously — over 600% for considerable periods.
Unusual efficiencies have been secured on the units so equipped.
Today they are in the same condition as when installed.
C-E Fin Furnace walls forecast new boiler performance records
Partial View of C-E Fin Furnace at Hell Gate
Combustion Engineering Corporation

From a page in Power Sept. 16, 1924

"The side wall tubes are practically in the same condition today as the day they were installed.

"We have never had to replace a tube in the side walls and some of them have been running for over two years."

The two excerpts above are from a letter written March 31, 1926, on the C-E Fin Furnace Walls installed at Hell Gate.

INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

- Lopulco Pulverized Fuel System
- Frederick Multiple Retort Stoker
- Self-contained Stoker
- Coxe Stoker
- Type E Stoker
- Type D Stoker
- Type K Stoker
- Type H Stoker
- Green Natural Draft Stoker
- Green Forced Draft Stoker
- C-E Fin Furnaces
- C-E Air Heaters
- C-E Unit System (Pulverized Fuel)
- Grieve Grates
- Combusco Ash Conveyors
- Quinn Oil Burning Equipment
- Combustion Steam Generator
- Ladd Water Tube Boilers

Combustion Engineering Corporation

43 Broad St. New York — Offices throughout the World

A SUBSIDIARY OF INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

A Much More Attractive P

RAYMOND MILLS with Air Separation remove grit and long fibres from 1,250 lbs. of asbestos floats or dust per hour for the Connecticut Telephone & Electric Co., Meriden, Conn.

Before Raymond Mills with Air Separation were installed foreign material in the asbestos floats caused rapid wear of the dies used in the manufacture of cold molded asbestos insulation. Yellow specks or streaks also appeared in what was an otherwise black product, spoiling the appearance.

Since the installation of a Raymond Mill wear on dies has been greatly lessened and the cold molded asbestos insulation has a much more attractive appearance.

The Raymond Pulverizers crush the bundle of fibres and then separate, by suction, the floats from the long fibres and grit which fall back and are later removed, sacked and sold. Between 90 to 95% of the final product will pass a 14 mesh screen.

This Mill has been in operation 3½ years, 7 hours a day, 280 days per year, and not a cent has been spent for repairs.

A report on this installation IS NOW available for those who have grinding and refining problems.

The Raymond Bros.

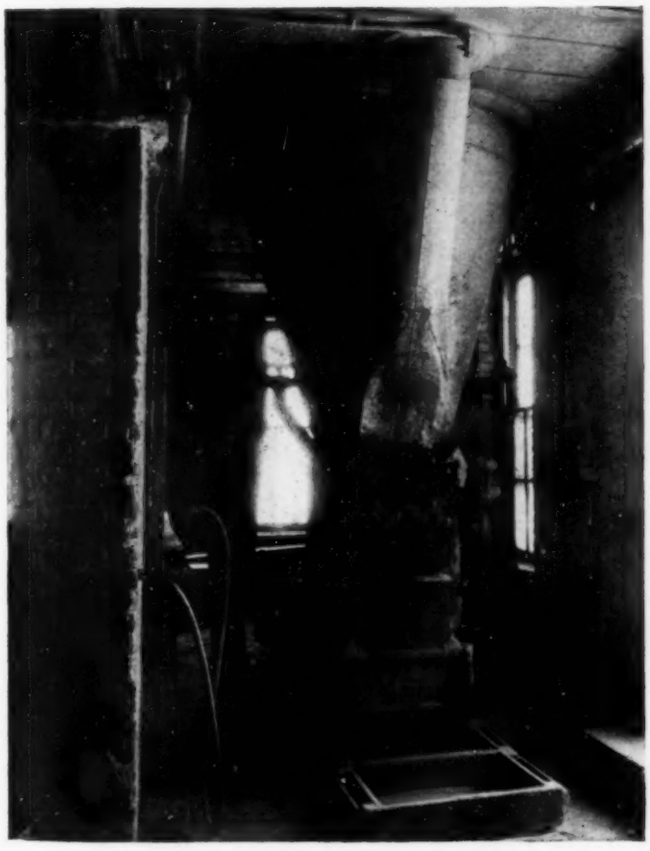
A Subsidiary of International

342 Madison Ave., New York

1315 North Branch St.,

Product at Less Cost

RAYMOND MILLS with Air Separation are saving money in varions processes by separating impurities from the raw materials during the pulverizing process.



Raymond Mill at
Connecticut Telephone & Electric Co.
Meriden, Conn.

For example:

Small balls of pure lime, core, overburnt materials, clinker and sand are removed from hydrated lime, assuring an even white plaster.

Silica contents are removed when lime is pulverized to be used as a filler for paper, rubber, etc.

Clay is pulverized to an impalpable powder; mica sand and other materials are removed.

Scores of other materials can be refined while pulverizing if you pulverize the Raymond way.

Impact Pulverizer Co.

Combustion Engineering Corporation

Chicago

Cotton Exchange Bldg., Los Angeles

For a Dry, Waterproofed, Perfectly Insulated Product

Special impregnating apparatus, size 14 ft. high x 8 ft. wide, made from sheet steel, with external bracing for high vacuum.

Devine Drying and Impregnating Apparatus

DEVINE COMBINED CABLE DRYER AND VULCANIZER

HIGHER electrical efficiency and higher voltages are ensured, for example, by the proper impregnation of Armature, Field, Magnet and Transformer Coils, Power and Telephone Cables, Insulator Pins, etc. The finished products give longer life and better service.

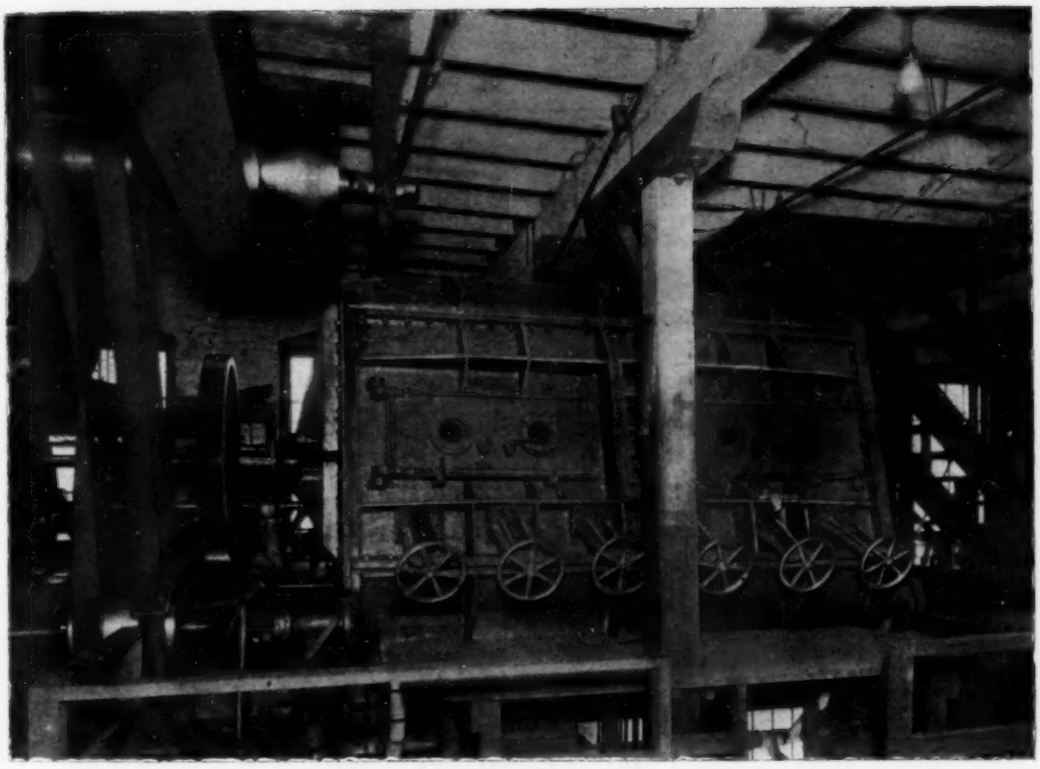
DEVINE has had fully rounded experience in this field—Devine apparatus being used in a hundred kinds of applications, from the impregnation of woods with colors and stains for the reproduction of imitation high-grade woods, to the impregnation of fabrics, asbestos packings, railroad ties, etc., etc.

The equipment usually consists of a Vacuum Drying and Impregnating Chamber to hold the material to be impregnated and a Liquor Tank for the storage and liquefying of the impregnating compound. Piping, jacketing, condenser and a Devine special combined Vacuum Pump and Air Compressor also are utilized. Write for Bulletin No. 104-A, which gives an interesting description.

J. P. DEVINE CO.

BUFFALO, N. Y.

DEVINE



DEVINE
VACUUM
DRUM
DRYER

Continuous Operation without Vacuum Breaking

A NOTEWORTHY feature of the Devine Vacuum Drum Dryer installation here pictured, is the arrangement of the Dry Material Receivers with conveyor and valves—so that the Dryer may be operated continuously without breaking vacuum or unloading receivers. Thus the dryer's capacity is greatly increased, and a uniform product insured throughout the day's run.

When the dried material is scraped off the drum surface, it drops into a trough containing the reversible spiral conveyor—which carries the material to one end of the trough, where it drops through an open valve into a receiver. When this receiver is full, the valve above it is closed, the valve on the opposite end of the trough is opened, the conveyor is reversed and the other receiver is filled.

DEVINE not only supplies the Dryer for any sort of application, but also—when requested—specifies the entire system and furnishes all accessories.

J. P. DEVINE CO.
BUFFALO, N. Y.

DEVINE
Products

Vacuum Evaporators
Vacuum Pans
Vacuum Chamber Dryers
Vacuum Rotary Dryers
Vacuum Impregnators
Vacuum Stills
Vacuum Condensers
Vacuum Pumps
Vacuum Drum Dryers
Kettles
Stills
Columns
Retorts
Caustic Pots
Sulphonators
Digesters
Autoclaves
Nitrators

SPEED CHEMICAL LIME—THE STANDARD OF UNIFORMITY

Dependability—your essential ally

IN EVERY industry dependability of materials and men is essential to permanent success. Both must be selected, first for ability and then for dependability. Hand-picked from sub-strata Indiana limestone of unusual purity, invariably high in calcium and calcined in gas-fired kilns, Speed Chemical Lime has for many years been relied upon by the chemical manufacturer as a base of dependable uniformity, efficiency and economy. A trial order of Speed Lime will convince and probably convert you.

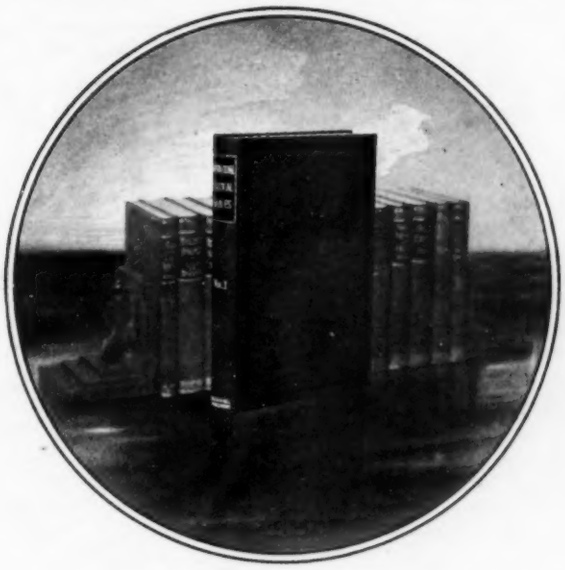
LOUISVILLE CEMENT CO., *Incorporated*, Louisville, Ky.

SPEED LIME

CHEMICAL SPEED LIME

CHEMICAL SPEED HYDRATED LIME

A large plant capacity and well-organized traffic department insure prompt shipments anywhere, any time. Speed Lime is sold in bulk, in paper-lined wood barrels or in waterproof jute bags—the Hydrated Lime in 50-pound paper bags. *Send for literature and samples—better yet, a trial order.*



Volume One

of

International Critical Tables

of Numerical Data of Physics, Chemistry and Technology

is now ready

(Produced under the direction of the National Academy of Sciences and the National Research Council)

The work of compiling *International Critical Tables* was undertaken by the National Research Council at the request of the International Union of Pure and Applied Chemistry, with the endorsement of the International Union of Pure and Applied Physics, and under the auspices of the International Research Council.

The material contained in *International Critical Tables* has been collected and critically evaluated by some 300 Cooperating Experts, including chemists, physicists, and engineers of the United States, Canada, Great Britain, Belgium, France, Italy, Austria, Germany, Denmark, Switzerland, Holland, Australia and Japan.

Some idea of the magnitude of the venture may be gained from the fact that the editorial, contribution and manufacturing costs have been appraised at $570,000.

One hundred and fifty thousand announcements of the special pre-publication offer were mailed to all parts of the world. Some of these announcements were printed in French, some in German, and some in Italian while more than half of them, of course, were in English.

This special pre-publication offer, which closed on May 1st, brought in subscriptions for nearly 6,500 sets. Of these almost exactly 20% were from foreign countries. The largest number of foreign subscriptions—296—came from Great Britain and Ireland. Germany sent 184. Holland was third with 95. Japan was fourth with 83. Seventy-one subscriptions came from Sweden. France sent 53 and Italy 52, while Belgium followed closely with 49. Switzerland sent 46; China, 39; Czecho-Slovakia, 37; Norway, 36; India 27; Denmark, 26; Russia, 22. The remainder of the foreign subscriptions are scattered among the far corners of the earth; witness, 19 from the Argentine Republic and 7 from Finland; 2 from Jerusalem and 1 from Samoa; 1 from Tasmania and 1 from Iceland; 7 from Hawaii and 2 from Siam. Even Egypt and Liberia, Ceylon and Esthonia, and far-off Java are represented.

The very fact that more than 1,300 foreign scientists promptly sent in subscriptions for *International Critical Tables* suggests the unprecedented position of the work in the world's technical literature.

5 volumes, sold on orders for sets only—per set, $60.00

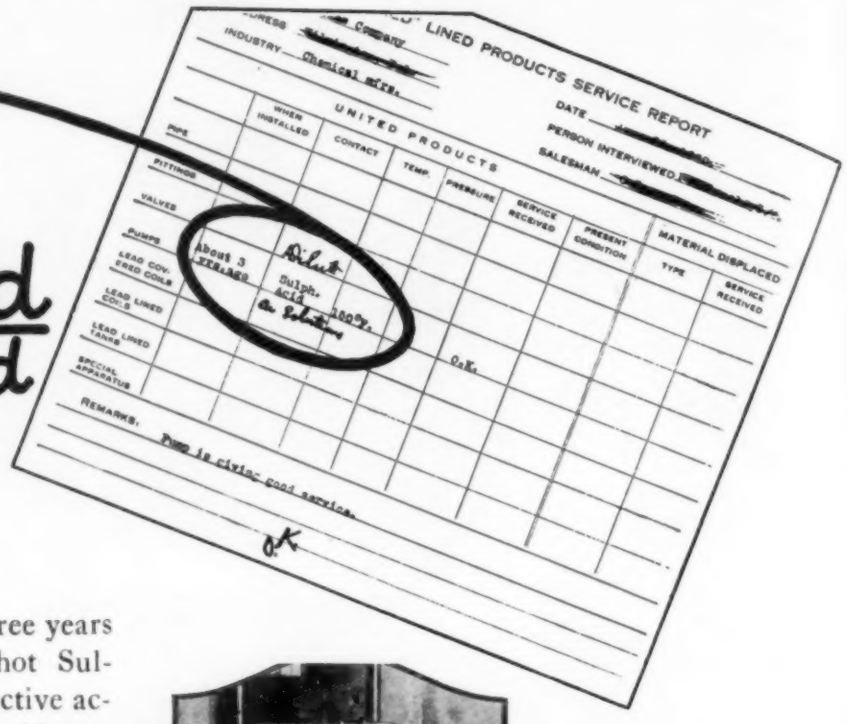
Payable at the rate of $12.00 per volume as the volumes are published

The outstanding achievement of American technical publishing

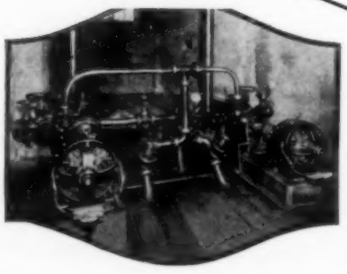
McGRAW-HILL BOOK COMPANY, Inc.

370 Seventh Avenue **New York**

3 Years of Hot Acid never harmed this Pump



THIS is a *real* test! After three years of continuously handling hot Sulphuric Acid—with all the destructive action that this ordinarily implies,—if your pump still remains in the running and at top efficiency besides, you can state unreservedly that you own a *mighty good pump*.



The Service Record reproduced here is not an exceptional "UNITED" case. We can show you many more spectacular records—because a "UNITED" installation *invariably* is *permanent*. Plant after plant throughout the Process field put their "O.K." on "UNITED" **Hard Lead Centrifugal Acid Pumps,** and point the way to your absolute assurance of Acid Pump efficiency.

An easy method of avoiding interruptions to process, the dangerous destructiveness of acid-leaking equipment, and costly repairs and replacements, is simply to *specify* "UNITED." Write for Catalog describing "UNITED" products, and copies of Service Records in your Industry.

For a SURE SAVING use "UNITED"

Chemical Lead Lined Pipe and Fittings for the handling of Dilute Sulphuric, Sulphurous and other acids, mine and salt water, etc.

Tin-Lined, Brass-Lined and Copper-Lined Pipe and Fittings.

Chemical Lead and Tin Covered Pipe and Fittings.

Acid Valves.

Hard Lead Centrifugal Acid Pumps.

Chemical Lead Lined Equipment.

"United" Lined is the LEAKPROOF kind

"UNITED" equipment has an enviable record of success in Industries such as: Cellulose Products—Dyestuffs—Explosives—Fine Chemicals—Heavy Chemicals—Leather—Coal Products—Lime—Food Products—Paint and Varnish—Paper and Pulp—Petroleum—Rubber—Soap—Fertilizer—Metals and Alloys—Wood Products. Investigate!

UNITED LEAD CO

111 BROADWAY. NEW YORK, U.S.A.

Canadian Distributors: Hoyt Metal Co., Toronto

Profitable Operation
of
CHEMICO-BUILT PLANTS
from smallest to largest

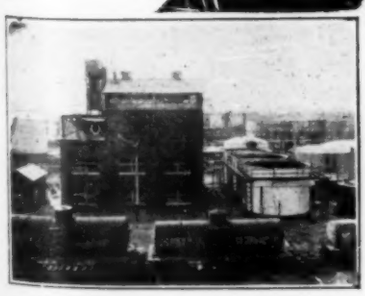
Specialists in
CHAMBER
CONTACT
TOWER
PRESSURE
Systems

SULPHURIC ACID PLANTS—whatever their **CHEMICO** type—are constructed along the most advanced, most practical engineering lines.

The **CHEMICO** organization itself is a completely-rounded, affiliated group of Chemical, Electro-Chemical and Constructing engineers who have had thoroughgoing experience with every phase of acid plant operation and requirements.

CHEMICO-built Acid Plants therefore are notable for low costs of construction, operation and maintenance, as well as most productive results. If desired, your **CHEMICO** plant is actually running when turned over to you.

Whether you are thinking of new construction or profitable remodeling, you can safely entrust your problem to the **CHEMICO** engineers. Write for information.



CHEMICAL PLANTS → **CHEMICO** ← CHEMICAL PROCESSES

CHEMICAL CONSTRUCTION COMPANY

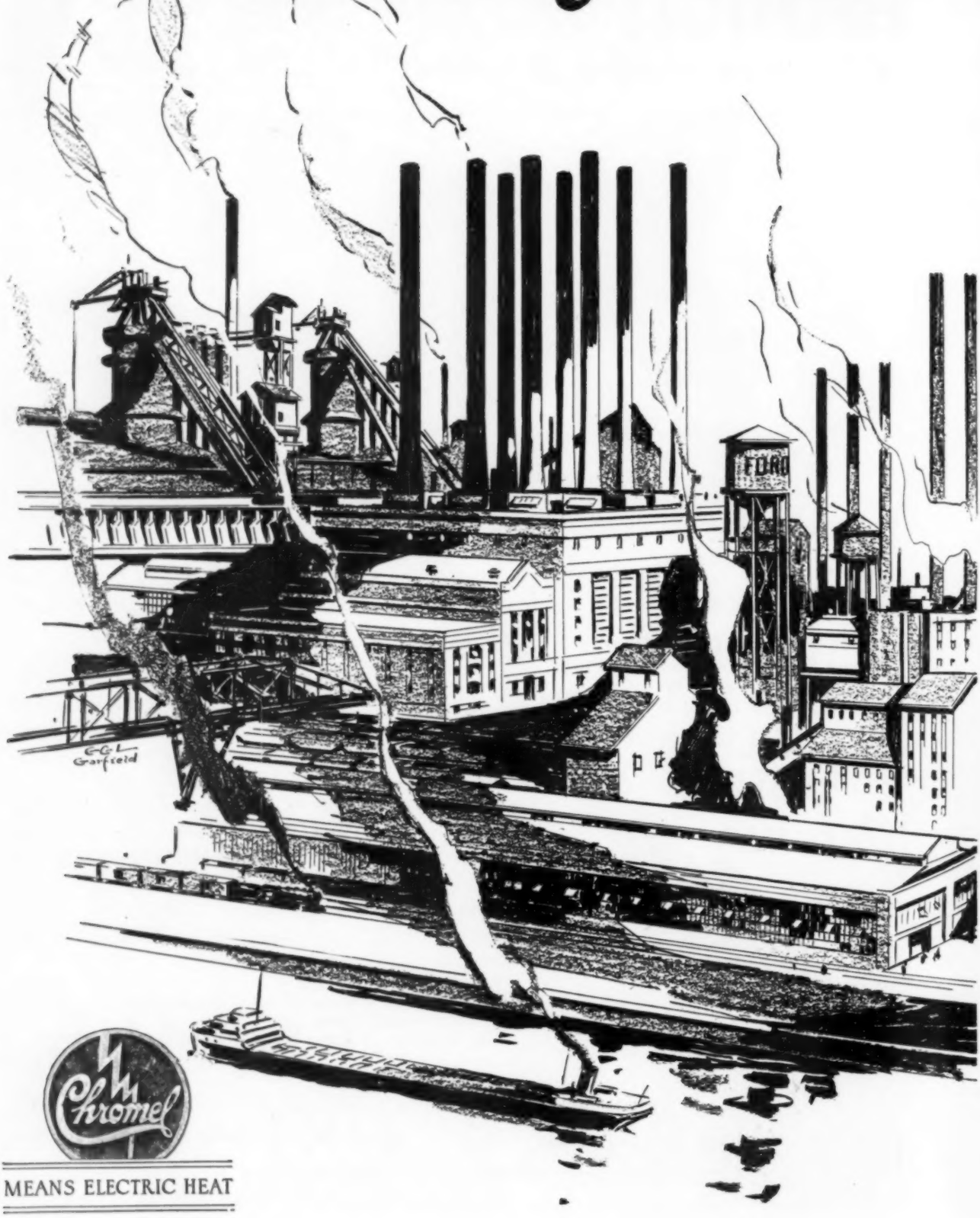
Main Office: Charlotte, N. C. **New York: 50 E. 42nd St.**

—or—

ATLANTA OFFICE OF THE B. MIFFLIN HOOD BRICK CO.

Sole Possessors of Manufacturing Rights

... *is* Henry Ford



Chromel

MEANS ELECTRIC HEAT

usually right?

He is right at least, we may assume in knowing the most economical manufacturing processes — methods that lead to the greatest profits.

It is significant then, that he is now using electric heat to the tune of 35,000 K.W., as his connected heating load. It is more significant that plans are now being completed to increase this load to 60,000 K.W.

This electric heat is being used for heat-treating of steel, for annealing, for enameling, and on glass lehrs. In fact, wherever Ford uses heat in his manufacturing processes, he is trying to use electric heat.

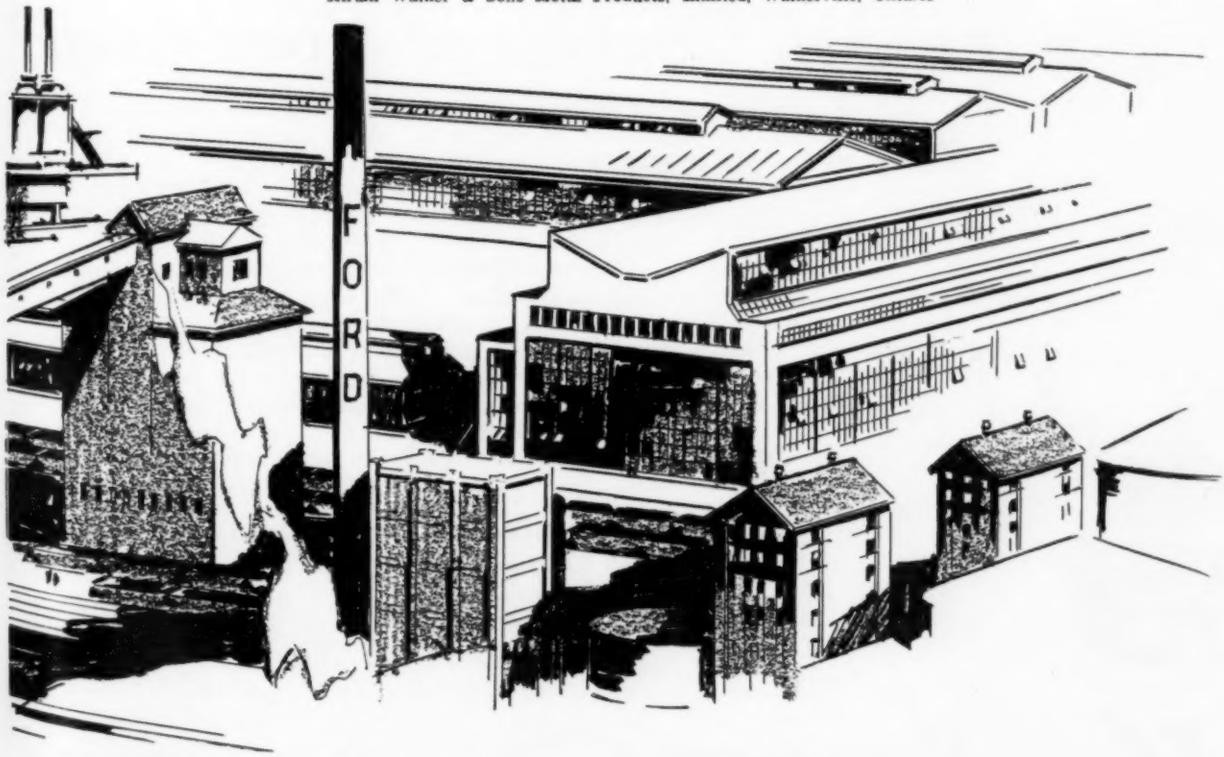
These facts definitely prove the practicability and economy of electric heat. And, surely they suggest to you to investigate electric heat for your own processes. If you are interested in costs, this is your responsibility. Where electric heat fits the job, it invariably means better work at lower cost.

And be sure that the resistors are made of CHROMEL. For technical data, send for Catalog EC.

HOSKINS MANUFACTURING COMPANY
4433 Lawton Avenue, DETROIT, MICHIGAN

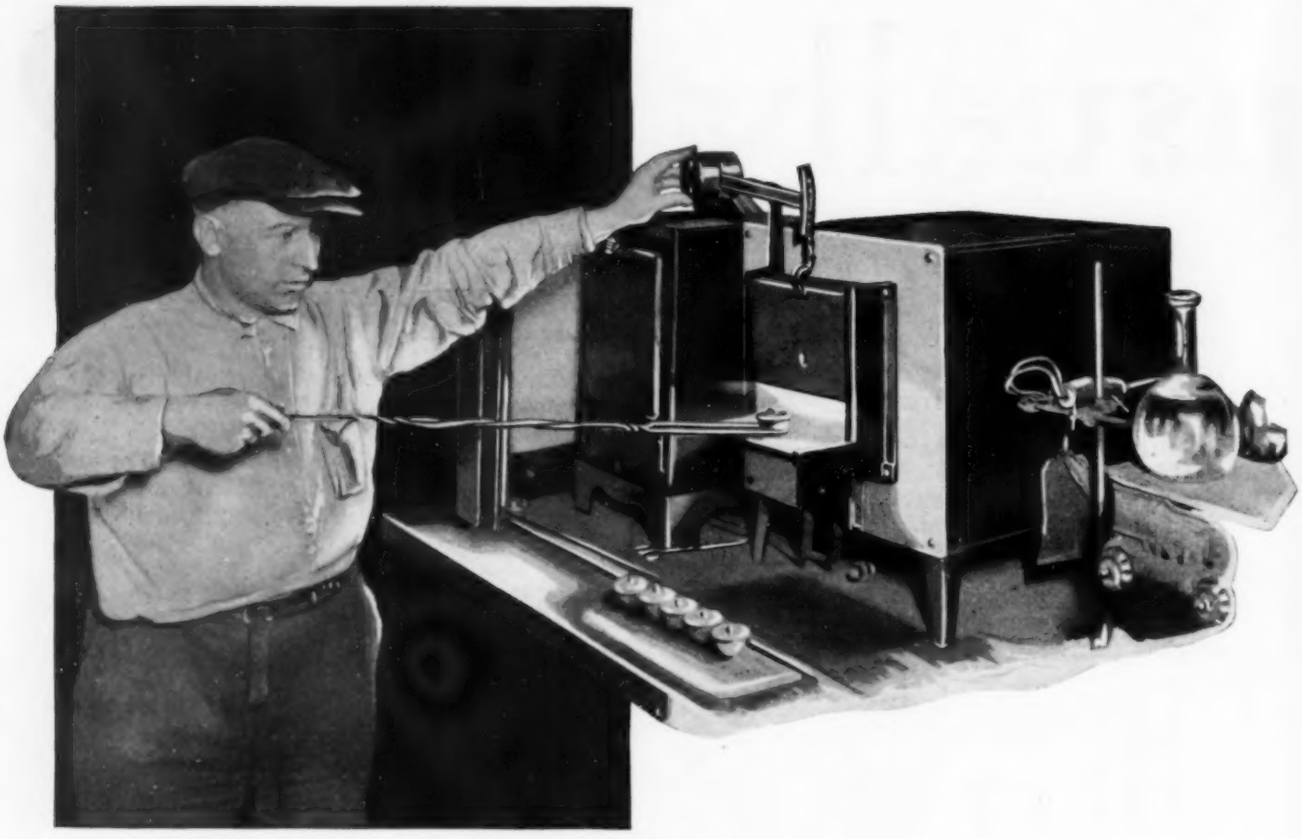
New York, *Grand Central Terminal* · Chicago, *Otis Building* · Cleveland, *Leader-News Building*
Boston, *Park Square Building* · San Francisco, *1151 Market Street*

CANADIAN REPRESENTATIVES
Hiram Walker & Sons Metal Products, Limited, Walkerville, Ontario



Hoskins Chromel

THE WIRE THAT MADE ELECTRIC HEAT POSSIBLE



What's the Ash Content of Your Coal?

If the ash content of your coal is important to you, then of course you want to determine it accurately. And you want to run several tests at one time.

These are two of the reasons why the Milwaukee Coke and Gas Company, according to Mr. G. H. Selke, Chief Chemist, uses a Hoskins Electric Furnace for that work. The furnace is operated at 850 deg. C. and the Chromel units, says Mr. Selke, last a long time.

Hence, they need renewal seldom. But when a new one is required it is easy to install. The Chromel unit, shaped like a long spring, is merely wrapped around the grooved muffle, as shown in the illustration below.

Whatever your laboratory needs for an electric furnace may be, it is likely that some Hoskins Furnace will meet the requirements. And when you install it you can forget it. For more information, write to your dealer.

Hoskins Manufacturing Company
4439 Lawton Ave., Detroit

BOSTON, Park Square Bldg. — NEW YORK CITY, Grand Central Terminal — CLEVELAND, Leader-News Building
CHICAGO, Otis Building — SAN FRANCISCO, 1151 Market Street

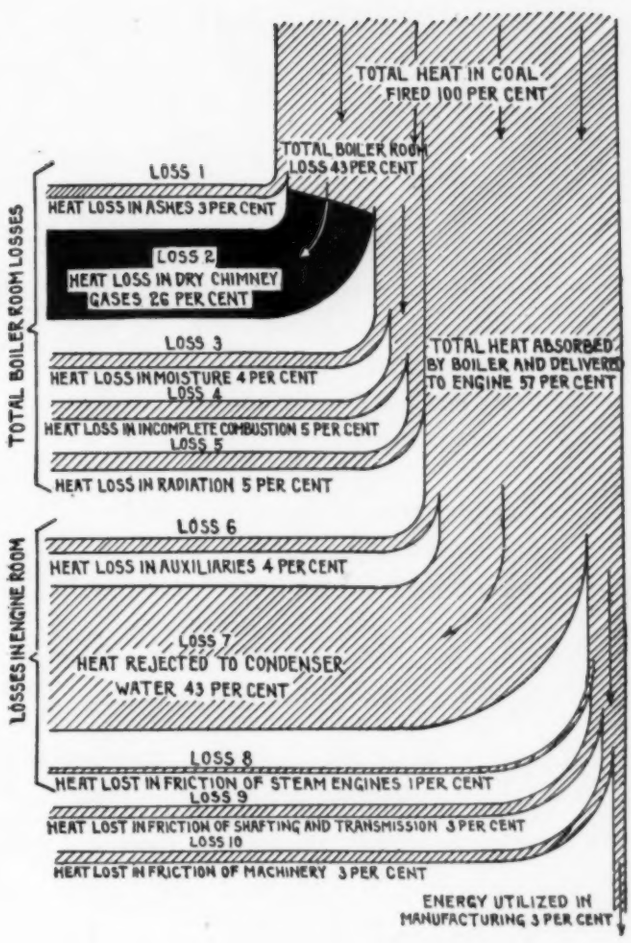
Canadian Representative: Hiram Walker & Sons Metal Prod., Ltd., Walkerville, Ont.

Hoskins Electric Furnaces

Originators and Manufacturers of Chromel — The Alloy that made Electric Heat Possible

C-E AIR HEATERS Cut This Loss in Half

According to data on average industrial plants obtained by the Bureau of Mines, 26% of the heat energy in coal escapes up the stack.


TOTAL HEAT IN COAL FIRED 100 PER CENT
TOTAL BOILER ROOM LOSS 43 PER CENT
LOSS 1
HEAT LOSS IN ASHES 3 PER CENT
LOSS 2
HEAT LOSS IN DRY CHIMNEY GASES 26 PER CENT
LOSS 3
HEAT LOSS IN MOISTURE 4 PER CENT
LOSS 4
HEAT LOSS IN INCOMPLETE COMBUSTION 5 PER CENT
LOSS 5
HEAT LOSS IN RADIATION 5 PER CENT
TOTAL BOILER ROOM LOSSES
TOTAL HEAT ABSORBED BY BOILER AND DELIVERED TO ENGINE 57 PER CENT
LOSS 6
HEAT LOSS IN AUXILIARIES 4 PER CENT
LOSS 7
HEAT REJECTED TO CONDENSER WATER 43 PER CENT
LOSSES IN ENGINE ROOM
LOSS 8
HEAT LOST IN FRICTION OF STEAM ENGINES 1 PER CENT
LOSS 9
HEAT LOST IN FRICTION OF SHAFTING AND TRANSMISSION 3 PER CENT
LOSS 10
HEAT LOST IN FRICTION OF MACHINERY 3 PER CENT
ENERGY UTILIZED IN MANUFACTURING 3 PER CENT

Heat formerly escaping through stack gases is utilized to preheat the combustion air.

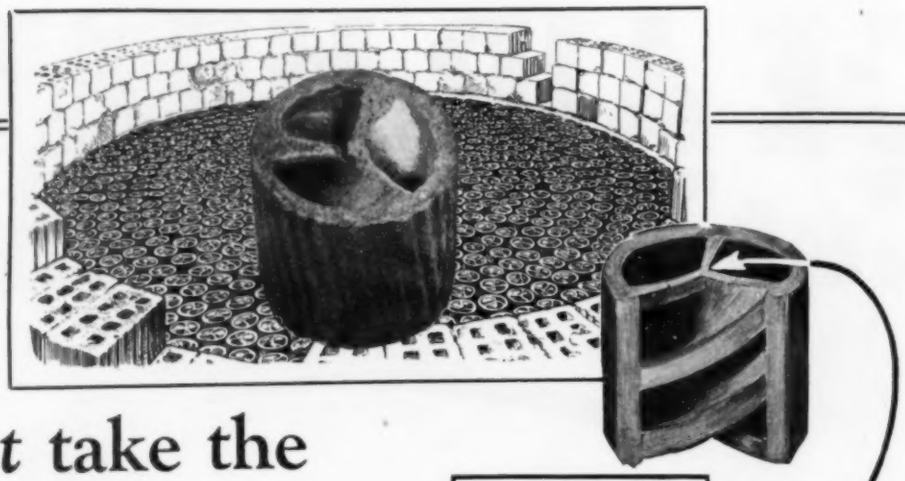
In addition, savings are accomplished due to

Better furnace conditions.
Increased boiler heat absorption.
Reduced ash pit losses.
Higher CO_2.

Combustion Engineering Corporation

43 Broad St. New York — Offices throughout the World

A SUBSIDIARY OF INTERNATIONAL COMBUSTION ENGINEERING CORPORATION



No hole at axis:

Large Surface

Large Free Space

They *must* take the spiral paths

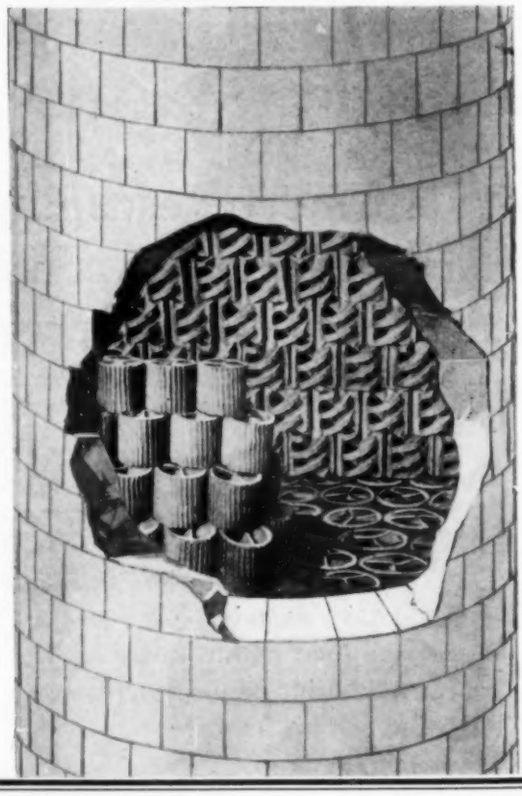
ALL the liquids and gases passing through the tower have to travel the three separate spiral passages. The tile pack 55 to the cubic foot and give 36 square feet of surface and 60% free space. This affords very excellent baffling and scrubbing without excessive gas friction and practically eliminates any possibility of gas channels forming in the packing.

Large surface exposed to liquids and gases creates greater tower efficiency wherever heat transfer from gas to liquid is required; where gases are absorbed by liquids, or expelled from liquids by the action of heat.

Triple Spiral Tower Packing Tile measure up to this high standard of efficiency. Write us for a sample.

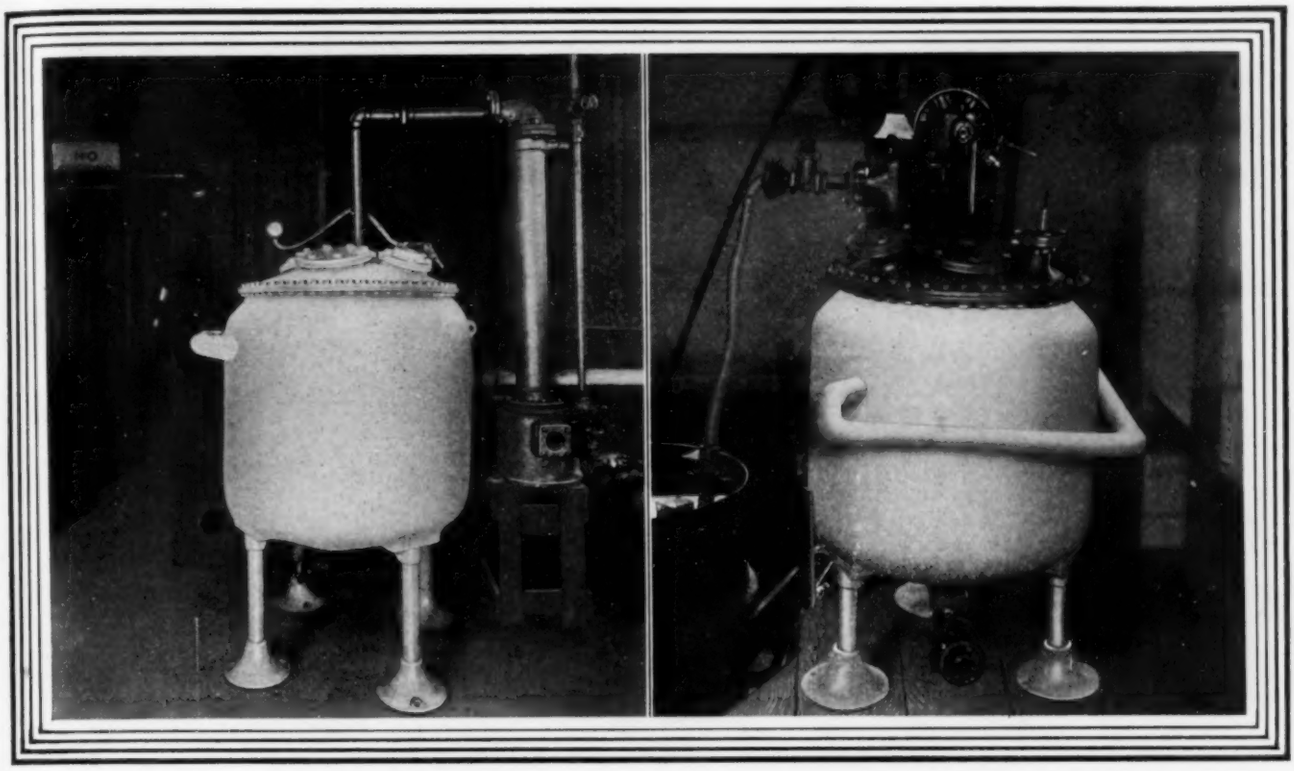
6 Maximum Efficiency POINTS

1—Greatest possible scrubbing surface and free space.
2—Simple and durable construction.
3—Self supporting, with no appreciable lateral pressure.
4—Easily packed in square or round towers.
5—Good distribution of the gas and liquid.
6—Low initial cost.



Chemical Appliances, Inc.
50 E. 42nd Street
New York

Improve Your Tower By Using TRIPLE SPIRAL TOWER PACKING



75 Gallon Pfaudler Glass Lined Kettle Used for Concentrating Water Solutions of Phenol Arsenic Acid Under Vacuum —
Arsphenamine Dept.
E. R. SQUIBB & SONS, N. Y.

50 Gallon Pfaudler Glass Lined Kettle Used as a Reactor for Phenol and Arsenic Acid in the Manufacture of Phenol Arsenic Acid (later concentrated)
Arsphenamine Dept.
E. R. SQUIBB & SONS, N. Y.

VIEWS FROM THE ARSPHENAMINE DEPARTMENT AT SQUIBB'S

The "Priceless Ingredient" of every product is the honor and integrity of its maker, says Squibb. And in order to protect its honor and integrity this great house of manufacturing chemists uses Glass Lined Equipment for its many sensitive reactions. They buy "Pfaudler" because they want the best.

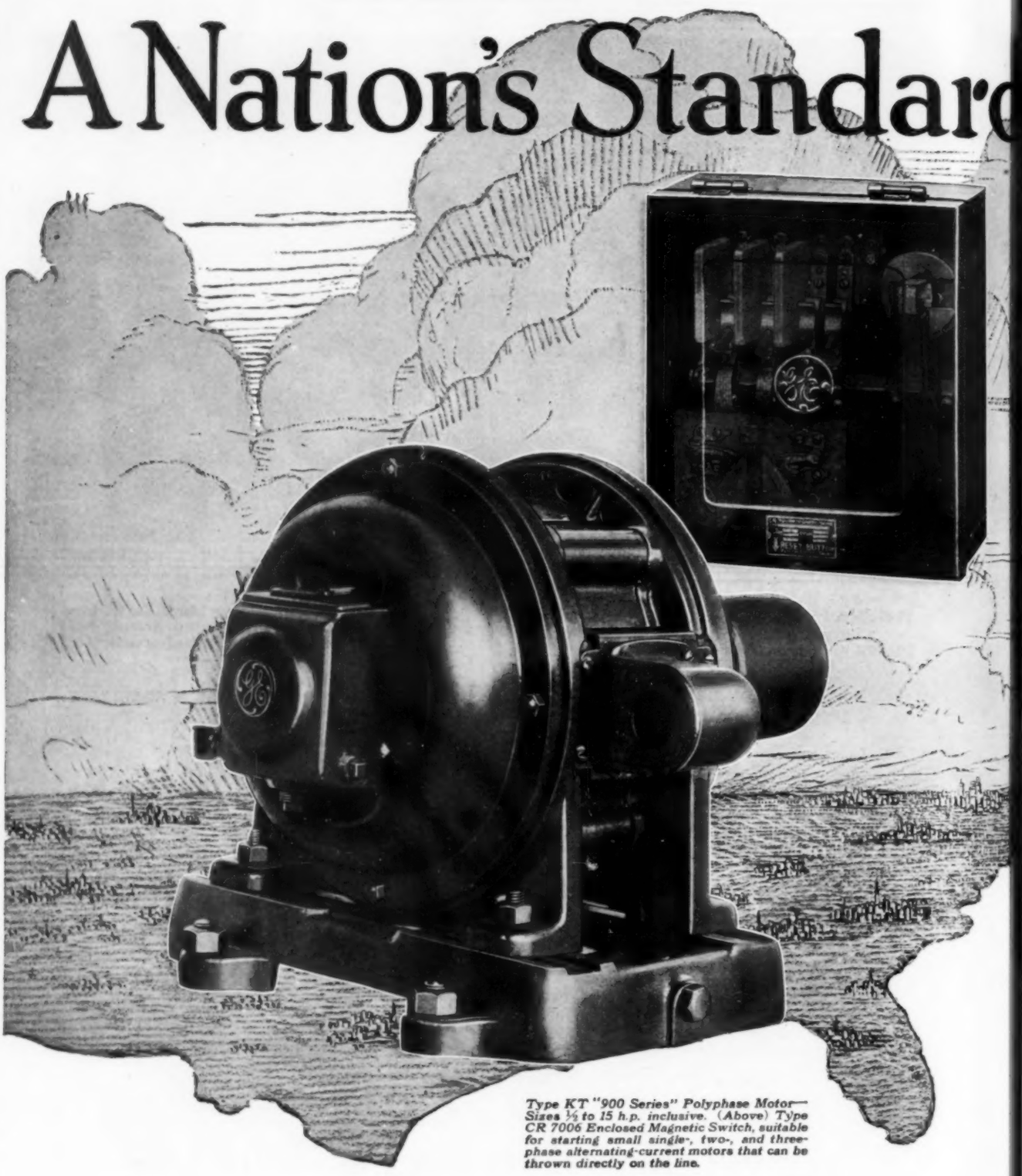
Booklets on Request

THE PFAUDLER COMPANY, *Chemical Division*
ROCHESTER, NEW YORK

STILLS — EVAPORATING PANS — STORAGE TANKS

PFAUDLER glass lined

A Nation's Standard G



Type KT "900 Series" Polyphase Motor—Sizes ½ to 15 h.p. inclusive. (Above) Type CR 7006 Enclosed Magnetic Switch, suitable for starting small single-, two-, and three-phase alternating-current motors that can be thrown directly on the line.

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

G-E Motorized Power

When you specify G-E Motorized Power, G-E specialists will study your electric drive problem—they will recommend the form of drive best suited, select the proper motor or motors from the extensive G-E line, include the suitable control equipment, and then see that the installation is satisfactorily made and serviced.

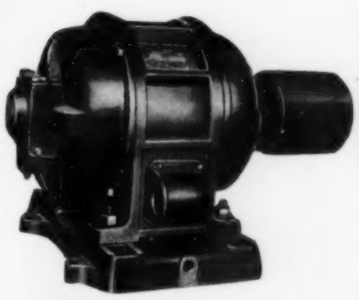
Whatever the circuit requirements or demands of service may be—whether the work be ordinary or extraordinary—whether you need a 1/200 h.p. motor or a giant of 22,000 h.p.—there is a G-E Motor to fit your need.

And for every G-E Motor there is suitable G-E control equipment—whether the requirements for starting, stopping, reversing, or motor speed regulation be simple or complex.

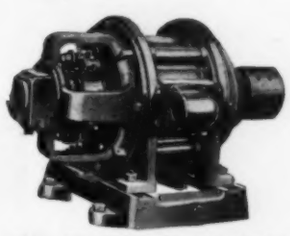
G-E Motorized Power is a practical means of increasing the productive ability and capacity of available man-power. "Built in" or connected to all types of industrial machines, G-E Motorized Power provides lasting assurance that you have purchased the best.

To obtain full value from your investments in electric motor drive, ask your nearest G-E office—or G-E Motor Dealer.

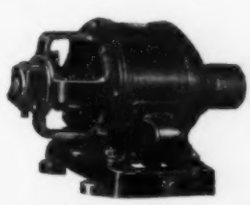
Four improved motors for general industrial uses



Type KT "500 Series" Induction Motor —Sizes 10 to 200 h.p. inclusive



Type SCR Single Phase Motor —Sizes ¼ to 1 h.p. inclusive



Type BD Direct Current Motor —sizes ½ to 3 h.p. inclusive

Type CD Direct Current Motor —Sizes 3 to 200 h.p. inclusive

MOTORIZED POWER
-fitted to every need

GENERAL ELECTRIC

7B-45

SALES OFFICES IN ALL PRINCIPAL CITIES

over 5,000

Dings High Intensity MAGNETIC SEPARATORS

now in service

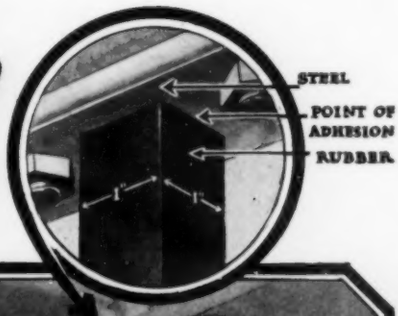
Have you an iron problem?
Solve it with a Dings!
Dings "High Intensity" Magnetic Separators are serving in refining and concentration, protecting crushers and grinders, taking tramp iron out of foods, feed, cosmetics, chemicals, rubber, cork, glass cullet and a variety of other materials. Dings are taking the black specks out of china, recovering iron from foundry slag and reclaiming foundry sand.
If it's iron, you need a Dings.

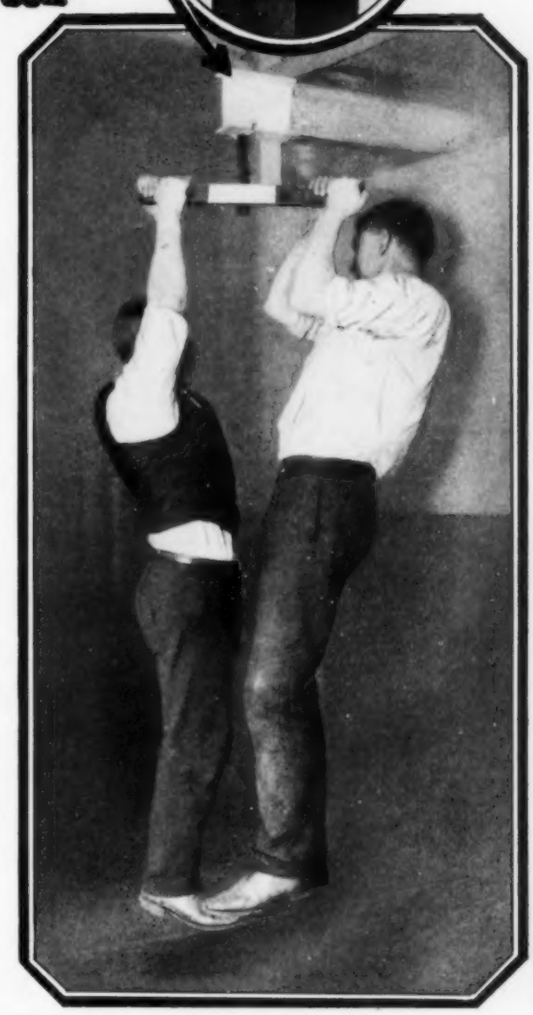
Dings Magnetic Separator Co.
666 Smith Street, Milwaukee, Wisconsin
New York: 52 Vanderbilt Ave.
San Francisco: 419 Call Bldg.
"The Largest Exclusive Builders of Magnetic Separators"

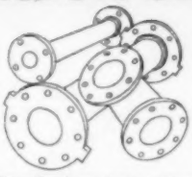
CM E6-Gray

Vulca-lock

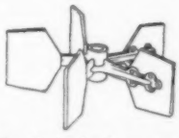
Rubber locked *to* Metal







Standard steel pipe lined with Vulca-lock rubber, also elbows, tees, valves and other fittings, for abrasive and corrosive service.



The Vulca-lock cover on fan blades, rotors and housings protects metal from corrosion and abrasion.

Goodrich Armorite (Vulca-lock process) standard steel sheets with rubber covering of any thickness to resist abrasion. These sheets may be bent, sheared or punched as required for lining chutes, screens, hoppers or any wearing surface.

Steel tank cars with Goodrich Vulca-lock rubber lining are in service throughout the country carrying muriatic acid and other corrosives.

Chutes and launders with Vulca-lock covering, applied in the Goodrich factory.

IN this test a strip of soft rubber 1 in. square was attached by a butt joint to a steel plate—the only connection between rubber and metal being one square inch of "Vulca-locked" surface. The joint easily supports the weight of two men.

• • •

"Vulca-lock" is a new process of attaching soft rubber to metal—not glued or cemented but "locked" by vulcanization into the "pores" of the metal with a union that is practically integral. No hard rubber bond is necessary.

This opens up innumerable opportunities to combine the stability of metal with the corrosive and abrasive resisting properties of soft rubber.

Some of the successful applications are illustrated here. Write us for further information and quotations.

THE B. F. GOODRICH COMPANY
Established 1870 *Akron, Ohio*

A Process Developed and Perfected by

Goodrich

Four Advantages of Gas

Economical—lowest final cost per unit of production.
Clean—comfortable factory working conditions.
Dependable—any time, any place, any quantity.
Controllable—exact temperatures, automatically controlled.

Gas is the Fuel for *Your* Factory

Some manufacturers are penny wise and pound foolish in the matter of fuel for their factories.

We do not claim that gas is always the *cheapest* fuel to *buy;* but we do say it is the most *economical* to *use.*

Beneath the surface, there are savings in gas that make it by all odds the most satisfactory of factory fuels!

Other factories similar to your own are changing to gas. There *must* be good reasons. They are told in our new book, "Gas—The Ideal Factory Fuel". A copy will be sent you on request.

American Gas Association
342 Madison Avenue :: New York City

YOU CAN DO IT BETTER WITH GAS

CELITE FILTER-AIDS

FILTER-CEL – *Standard* SUPER-CEL – *Hyflo* SUPER-CEL

A "Tempest" in a Filter Press

THE action within a filter press is a battle between contending forces. Picture the turbulent surge of the incoming liquid—the pressure of the pumps driving the suspended impurities against the filter cloths as they struggle to force their way through the resisting filter fabric.

Soon a thin, slimy film is formed on the cloths. As the "piling up" of impurities on the filter cloth continues the gummy film increases in thickness, the flow of liquid slackens, and very soon filtration comes to a standstill.

That is what happens where no filter aid assists in the struggle of the liquid to free itself of its suspended impurities.

An entirely different action occurs when the Filter-aid Super-Cel or Filter-Cel is added to the liquid to assist filtration. As the unfiltered liquid plus its *minute* percentage of filter-aid is forced into the filter press, the gums and other impurities are entrapped by the fluffy particles of filter-aid and prevented from penetrating into the pores of the filter cloths.

The filter-aid serves as a barrier to the penetration of gummy impurities into the cloth—but permits the ready flow of filtered liquid. As its particles intermix with gummy and slimy impurities, they build up a porous, uniform cake on the cloths which not only permits rapid rates of flow but also enables the filtration cycle to be lengthened greatly. When the press is cleaned the firm, porous cakes are readily "washed" in the press and easily dropped from the cloths.

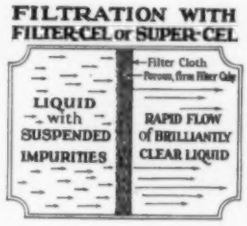
The difference in the struggle within the press is clearly apparent—without a filter-aid, thin slimy cakes with low rates of filtration and high cost of cleaning cloths—with Super-Cel or Filter-Cel, porous, firm filter cakes, high rates of flow, long cycles, brilliant clarity and low cloth cleaning expense.

Proper filtration is the determining point between success or failure in many processes.

That is why Celite filter-aids are known as *Barriers to Industrial Waste.*

FILTRATION WITHOUT A FILTER-AID

FILTRATION WITH FILTER-CEL or SUPER-CEL



CELITE PRODUCTS COMPANY

NEW YORK · · 11 BROADWAY
CHICAGO · 53 W. JACKSON BLVD.
LOS ANGELES · 1320 SO. HOPE ST.
SAN FRANCISCO · 140 SPEAR ST.

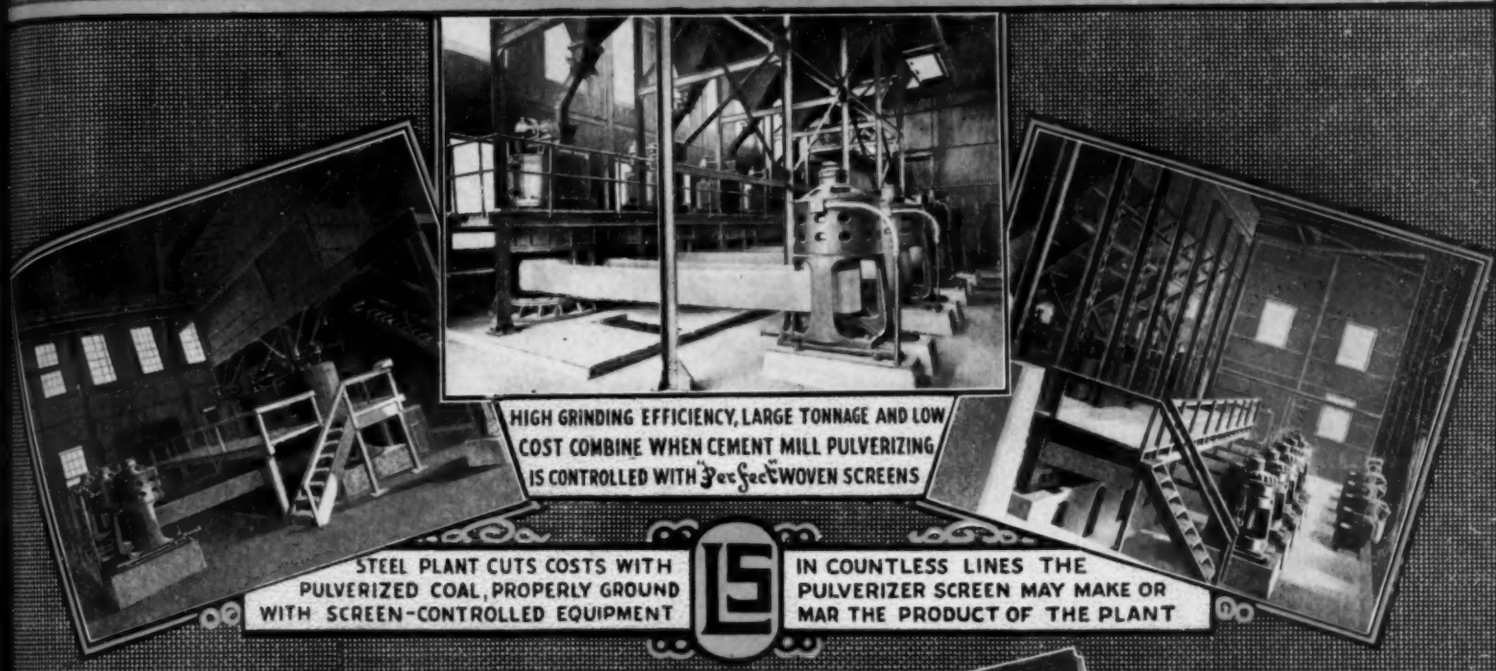
OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

CELITE PRODUCTS LIMITED
NEW BIRKS BUILDING,
MONTREAL · · QUEBEC

CELITE PRODUCTS CORPORATION
147 WINDSOR HOUSE WESTMINSTER
LONDON · · ENGLAND

Protect the joint
and save
the setting
GOOD firebrick have to be laid up with a good bonding cement if you want good service.
Protect them by using a high temperature cement that will stay with them and present a solid front to flame. Use Johns-Manville No. 31 Refractory Cement and you will soon discover that the same firebrick you are now using will give far longer service.
JOHNS-MANVILLE Inc.
292 Madison Ave., at 41st St., New York City
Branches in all large cities
For Canada: CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto
Asbestos
and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS
Use this T-joint
A 3/16" layer of "elastic" cement cushions expansion stresses.
The overlapping "T" protects brick edges against corner spalling.
A wash coat of Johns-Manville No. 32 gives a smooth surface that resists clinker.
JOHNS-MANVILLE
Refractory Cements

Faster, More Uniform Pulverizing with the Positive Separation of "Perfect" Woven Screens



HIGH GRINDING EFFICIENCY, LARGE TONNAGE AND LOW COST COMBINE WHEN CEMENT MILL PULVERIZING IS CONTROLLED WITH "Perfect" WOVEN SCREENS

STEEL PLANT CUTS COSTS WITH PULVERIZED COAL, PROPERLY GROUND WITH SCREEN-CONTROLLED EQUIPMENT

IN COUNTLESS LINES THE PULVERIZER SCREEN MAY MAKE OR MAR THE PRODUCT OF THE PLANT

For faster, more uniform pulverizing—
To control selective grinding—
For maximum gain from the process—
For minimum wastes in regrinding—
For more impalpable powder,
or minimum dust or slimes—

Whatever the problem, product or process, Ludlow-Saylor Wire Cloth, properly selected and applied to grinding equipments, will save you Power, Time, Attendance and Replacement costs, improve the grinder product, facilitate subsequent processing, and *produce more tons* per machine, per square foot, per man, per hour, per dollar.

The Ludlow-Saylor Screen Book is a Text-Book on Wire Cloth. Engineers and Operating Departments everywhere depend on it for handy, reliable and intelligent Wire Cloth data. The comprehensive tables list a Thousand Standard Screens BY MESH — and then re-list them all BY OPENINGS.

Hundreds of full-size illustrations simplify selection; and 5,000 wire cloth samples, always at your command, facilitate comparative tests. They make easy a discriminate choice of new screen surfaces, or a positive check on the screens you have been using.

Send for your copy of Screen Book No. 47-O3—
The Text-Book on Screens.
Free on request, of course—no obligation.

All views courtesy of The Fuller-Lehigh Co., makers of Fuller Grinding Mills and Pulverized Coal Equipments.

MEMO

THE LUDLOW-SAYLOR WIRE CO.
632 South Newstead Ave., St. Louis

Send us your New General Catalogue No. 47-O3. We use

Screening Equipment — Filter Equipment
Grinding Equipment — Tumbling Equipment

Send samples as follows: .....

....

Firm.....

By.....

Street.....

City.....

"Perfect" Service
1 COMPLETE SERVICE
2 ACCESSIBLE SERVICE
3 RELIABLE SERVICE
4 ADAPTABLE SERVICE
5 ECONOMICAL SERVICE

LUDLOW-SAYLOR WIRE C

Equipment Deliver Greatest Properly Processed Tonnage

Choice of screen cloth affects running time, shutdown time, equipment investment, floor space—all overhead items—*beside tonnage.*

For any purpose, at least a dozen kinds of screens can be made to answer. For instance, six are shown here in miniature, all suitable for the same separation. Properly applied, the products of all would be identical.

Choose the right screen, and with proper application the same equipment will turn out cleaner, more uniform work, require less attendance and power, and handle more tons per machine, per square foot, per screen-cloth, per man, per hour and per dollar.

For operating economy, two considerations far outweigh all others; they are: *Quality of product (or efficiency of subsequent processing).*

Variation of costs with the ratio of overhead per hour to tonnage per hour.

Only after these, may frequency, convenience or expense of replacements be considered.

Extreme Uniformity of Square Mesh Product

For meticulous elimination of oversize in fine screening, "Perfect" square mesh wire cloth stands alone.

Where the expense or convenience of replacement is important, specify heavy wires. A little engineering forethought, however, in pre-arranging screen replacements, will frequently effect the necessary changes of screen cloth without interruption to the process circuit.

Here lighter, faster-working, less expensive wires will multiply tonnage and improve the product.

The metal in Ludlow-Saylor fine wires has proved its temper and its quality in countless tonnage records. No crystallized metal here—no strains nor broken surfaces—but maximum resistance to abrasion, vibration, corrosion, pressure, shock, with minimum hindrance to flow of feed or passage of fines.

Rek-Tang Out-lives and Out-delivers

For coarser separations, where a cleaned or graded product is required, free from fines, Rek-Tang Screens excel. Unusually tough and heavy wires double and triple the strength and life of Rek-Tang Screens, without restricting output.

Greater tonnage and efficiency—more tons of cleaner product—result from using lighter wires and changing screens more often.

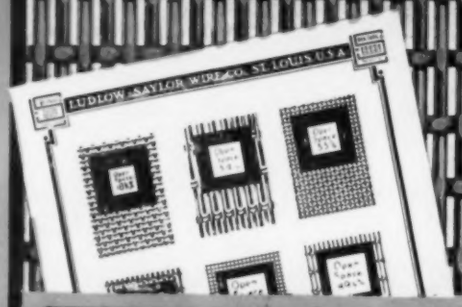
Weight for weight, wire for wire, hour for hour or screen for screen, Rek-Tang for ordinary separations will out-live and out-deliver any other classifying medium known today.

New Text-Book on Screens

In a 160-page book lately circulated, The Ludlow-Saylor Wire Company have turned out a complete text-book on screens and screening information.

Comprehensive tables list a thousand standard screens *by mesh;* a second section re-lists them all *by openings;* metric equivalents for all English designations, actual weights for all grades, and hundreds of actual-size illustrations make this book invaluable in the library of the process engineer.

Dozens of America's largest screen users have wanted extra copies for the engineering and operating men throughout their organizations. Practical screen men find it handy, dependable, intelligent. It is free on request, of course, to users of wire cloth or screens of any kind.

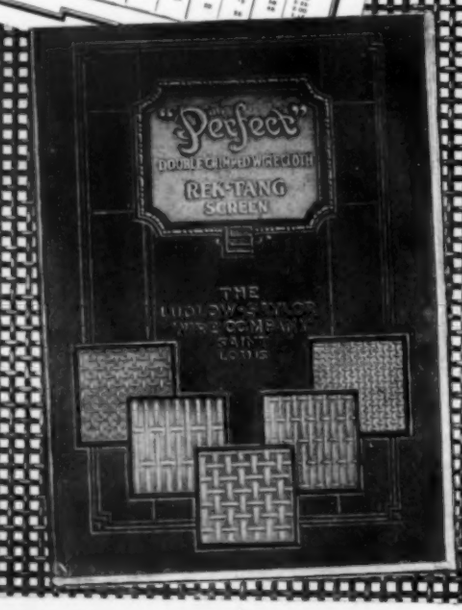


Dependable Wire Cloth Service

You can count on Ludlow-Saylor Service to handle all requirements to your best advantage . . Screen users of all America depend upon St. Louis for complete, reliable, economical and quickly accessible Wire Cloth Service

"Perfect" Service

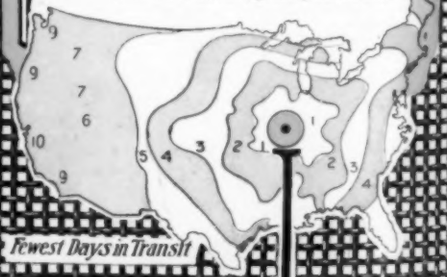
1 COMPLETE WIRE CLOTH SERVICE
2 ACCESSIBLE WIRE CLOTH SERVICE
3 RELIABLE WIRE CLOTH SERVICE
4 ADAPTABLE WIRE CLOTH SERVICE
5 ECONOMICAL WIRE CLOTH SERVICE



Ludlow-Saylor Service is Nearest to Your Needs

City	Days	City	Days
Albuquerque, N. M.	5	Little Rock, Ark.	2
Atlanta, Ga.	3	Los Angeles, Calif.	9
Baltimore, Md.	4	Louisville, Ky.	1
Birmingham, Ala.	2	Macon, Ga.	4
Butte, Mont.	6	Memphis, Tenn.	2
Chattanooga, Tenn.	2	Mobile, Ala.	2
Chicago, Ill.	1	New Orleans, La.	3
Cincinnati, Ohio.	1	New York City, N. Y.	3
Cleveland, Ohio.	2	Omaha, Nebr.	2
Columbia, S. C.	4	Philadelphia, Pa.	3
Dallas, Texas.	3	Pittsburg, Pa.	2
Denver, Colo.	4	Portland, Oregon	9
Des Moines, Iowa.	1	Richmond, Va.	4
Detroit, Mich.	2	Salt Lake City, Utah	6
El Paso, Texas	5	San Antonio, Texas	4
Ft. Wayne, Ind.	1	San Francisco, Calif.	12
Ft. Worth, Texas.	3	Seattle, Wash.	9
Houston, Texas.	4	Shreveport, La.	3

Mark all requisitions: "By Package Car from St. Louis"



The LUDLOW-SAYLOR WIRE COMPANY St. Louis

632 South Newstead Ave.

Lift the fog from plant operations

IT ISN'T lower sales figures, nor less advertising nor anything else that will help meet the super-competition of the future.

It's lower operating costs.

Dust is one of the objectionable features in all plants—make your plant a dustless plant by installing a modest priced Dracco System.

Not only that, but the Dracco System can help in reducing the costs of material handling. Dracco Pneumatic Conveying lines adapted to the handling of your particular materials—lime, gypsum, litharge, soda ash, sand, cement, chemicals, reduces your problem to an amazingly simple and inexpensive operation.

There is no waste—no clogging—no delays—no complicated apparatus and no manual labor.

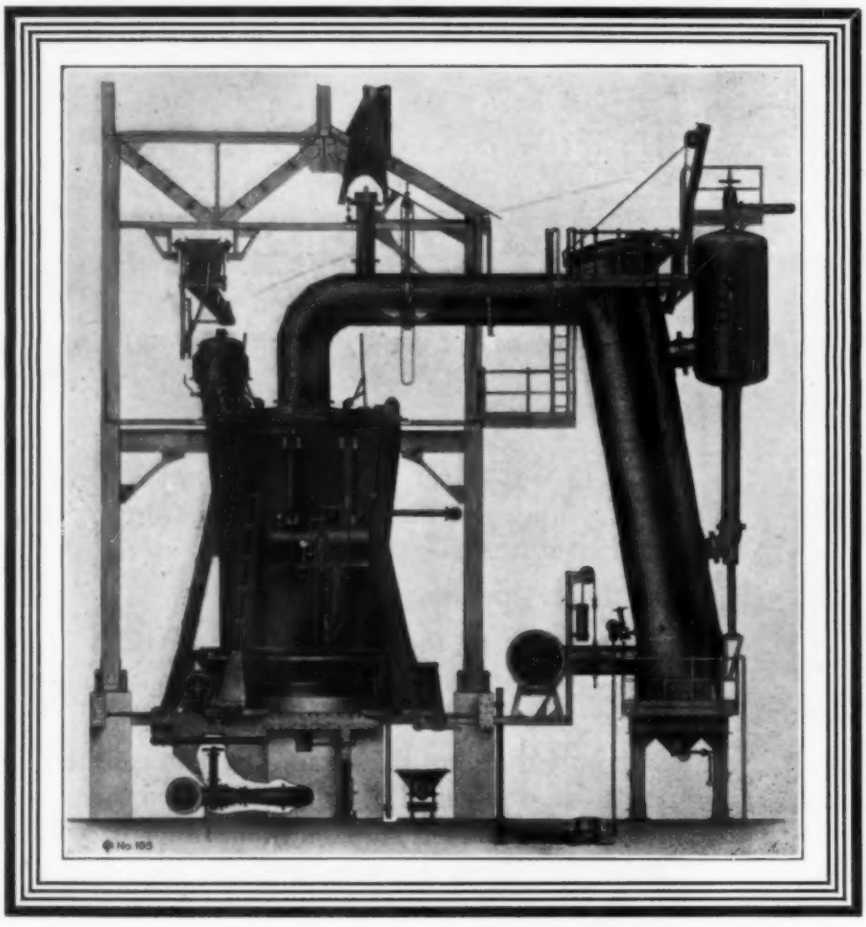
Our engineers can show you some interesting figures on savings accomplished in plant operations of other companies. They demand your interest, so send for pamphlets.

Dust Recovering & Conveying Co.
Harvard Avenue and East 116th Street
Cleveland, Ohio

DRACCO DOES IT

THE U. G. I. PRESSURE PRODUCER

is the result of scientific research in producer gas production.
It incorporates the best in the art.



Installed with a U.G.I. WASTE HEAT BOILER and using coke fuel, the U.G.I. PRESSURE PRODUCER constitutes the ideal unit of this character.

Its features include a water jacket, which eliminates the brick lining with consequent clinker troubles. The water jacket also serves as a low pressure steam generator.

Its mechanical cleaning feature eliminates shut-downs for cleaning and permits 24-hour continuous operation.

We would be glad to discuss it with you.

THE U. G. I. CONTRACTING COMPANY

Broad and Arch Streets Philadelphia

421 Peoples Gas Bldg., Chicago

ANNOUNCEMENT

THE rapid increase in the sales of the Merco Nordstrom lubricated plug valves evidences a growing conviction that the oldest known type of valve, namely, a plug cock, is also the best if a proper film of lubricant is maintained between the seating surfaces of the plug and body.

Patents suggesting lubricated plug cocks have appeared from time to time during the past twenty-five years or more, but none of these suggestions was successful because none of them embodied means for separating and sealing the seating surfaces by high pressure lubrication.

Nordstrom was the first to discover and apply the principle upon which the successful lubrication of plug cocks depends; his fundamental patent (U.S. Reissue No. 14,516) relates to two distinct improvements in plug valves, namely:—

1st. Means for introducing lubricant under high pressure in such a way as to separate the bearing surfaces and distribute lubricant evenly over them.

2nd. Means for resiliently holding the plug in a position slightly separated from its seat so that on appreciably thick film of lubricant can be maintained between them at all times.

The second construction is suitable chiefly for comparatively low pressure work, such as gas distribution. But the first improvement—that is, the separation and sealing of the seating surfaces by forcing lubricant between them—is applicable to all types of service.

We hold that any plug valve in which the seating surfaces may be separated or sealed by high pressure lubrication is an appropriation of Nordstrom's invention and infringes this patent, and we know of no other means of introducing and maintaining a proper film of lubricant between the seating surfaces.

The wide and increasing use of the Merco Nordstrom lubricated plug valve renders necessary the above statement in order that the users of these valves and other manufacturers may clearly understand our position.

MERCO NORDSTROM VALVE COMPANY

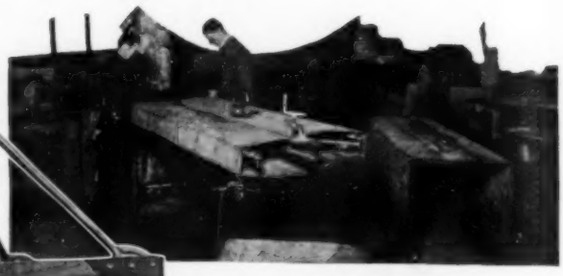
SUBSIDIARY OF THE MERRILL COMPANY

Engineers— MERCO *Manufacturers*

San Francisco 121 Second Street · New York 110 W. 40th Street · Chicago Peoples Gas Building · Houston 613 Washington Avenue · Cleveland 325 Engineers Building · *Agencies in Principal Cities*

MERCO NORDSTROM PLUG VALVES

Alcumite sheet



Alcumite ducts for the disposal of corrosive fumes or gases can be made by the customary sheet metal working methods.

A pickling basket made completely of Alcumite. Stock forms of Alcumite—sheet, angles, rivets, and rods were used in its construction.

A calked and riveted Alcumite tank, fabricated with Alcumite sheet, angles, and rivets.

FOR the manufacture of tanks, fume ducts, pickling baskets and other light, strong equipment for dealing with corrosives use Alcumite sheet, available from stock in standard gauges and widths.

Alcumite sheet is easily fabricated by standard methods. Alcumite rivets, bolts, nuts and washers can be supplied to make the equipment completely of Alcumite and so eliminate deterioration from electrolysis. Seams on tanks or containers are calked and riveted.

A complete range of corrosion-resistant equipment can be made of Alcumite. Forgings and castings, of any design practical with steel, are made to specifications.

A sample of Alcumite and advice on the manufacture of any type of corrosion-resistant equipment will be sent on request.

What Is Alcumite?

ALCUMITE is a non-ferrous alloy combining remarkable resistance to corrosion with great strength and ductility. It is one of the strongest non-ferrous alloys known. Cast, it has an average tensile strength of 75,000 pounds per square inch; hot rolled, as high as 90,000 pounds per square inch. It has a fine-grained, uniform texture; shows a great resistance to fatigue and abrasion; and retains its strength under high pressures and temperatures. It can be forged, rolled, sheared, punched, drawn, or machined as readily as mild steel and with the same equipment.

Alcumite is highly resistant to sulphuric acid of concentrations below 60 deg. Be. up to 210 deg. F.; weak muriatic; acetic; fruit juices; vegetable acids; and most corrosive fumes and gases encountered in industries. There are only a few solutions such as nitric acid and some of the chlorides, for use with which Alcumite is not recommended.

THE ALCUMITE CORPORATION

A division of The Duriron Co., Inc.

Dayton, Ohio

1054 Grand Central Terminal, New York City
110 So. Dearborn Street, Chicago, Illinois
830 Monadnock Building, San Francisco, California

Manufactured in Canada for Emmans, Limited
285 Beaver Hall Hill, Montreal, Quebec

Alcumite

The acid resistant metal with strength and adaptability like steel

Pumping Muriatic 20° Baumé

WILLIAMSBURG CHEMICAL CO., INC.
230 MORGAN AVENUE
BROOKLYN, N.Y.

TEL. 1700-1 STAGG

Mar. 21, 1926

CABLE ADDRESS
WILCHEM BROOKLYN
A.B.C. CODE 5TH EDITION

The Duriron Company, Inc.,
Grand Central Terminal Building,
New York City

Gentlemen:

Replying to your letter of Mar. 15th, wish to state that we have been using for some years the Duriron Centrifugal Pump for pumping Muriatic Acid 20° Baume, and it has always given us excellent service. This pump has made it possible for us to eliminate quite a lot of unnecessary handling and labor.

It is our intention to use your pumps wherever we have an acid conveying problem.

Yours very truly,

WILLIAMSBURG CHEMICAL CO. INC.

HG:RR

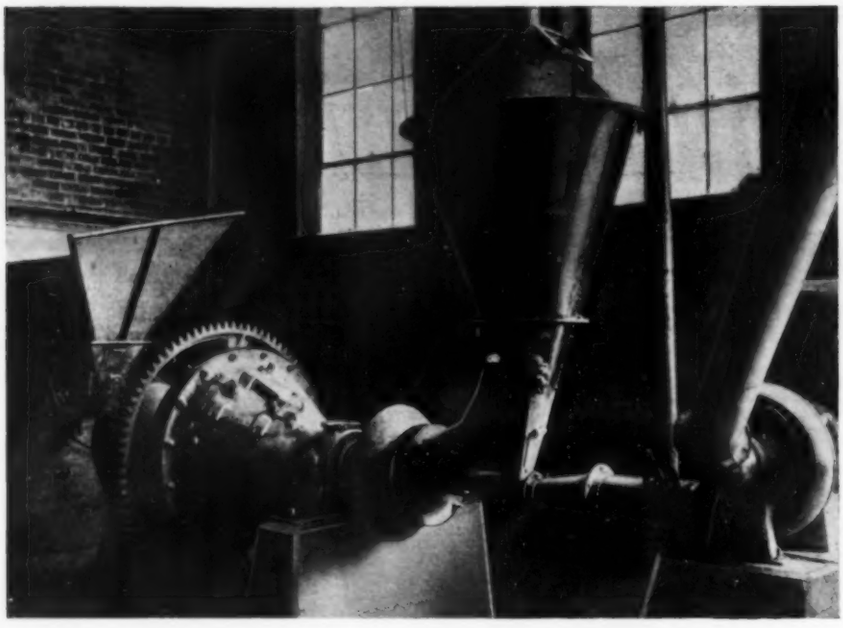
Duriron pumps give service and satisfaction to hundreds of users similar to that expressed in this letter.

With Muriatic, Nitric, Sulphuric, Phosphoric, Boric, Acetic, and practically all acids.

Duriron Centrifugal Pumps are produced in the following sizes:

2 in. suction by 1½ in. discharge—Series No. 102
4 in. suction by 3 in. discharge—Series No. 403
6 in. suction by 4 in. discharge—Series No. 604
8 in. suction by 6 in. discharge—Series No. 806

The DURIRON COMPANY
DAYTON · OHIO



What We Are Pulverizing

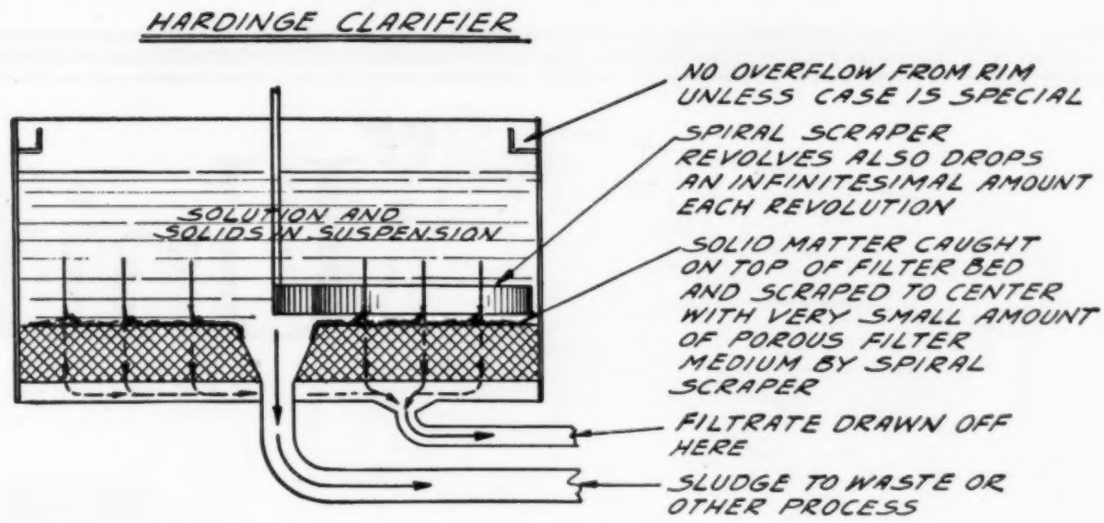
in the Hardinge Mill with Reversed Current Air Classifier and Pneumatic Conveyor

Silica Sand.	To 98.5% passing 325 mesh.	With no fan wear.
Feldspar.	To 95% passing 325 mesh.	Absolutely clean plant.
Manganese.	To 60% passing 100 mesh.	Fines not needed.
Clay.	To 90% passing 80 mesh.	High in moisture, but grinds just the same.
Barytes.	To 99.5% passing 325 mesh.	Very rigid tests required.
Coal.	To 85% passing 200 mesh.	Beats anything ever done in the way of economical results.
Cocoa Shells.	To 100% passing 10 mesh.	A difficult job well done.
Phosphate Rock.	To 95% passing 80 mesh.	No dust in the plant.
Grog.	To 90% passing 100 mesh.	So hard it will cut glass, but can't hurt mill or classifier.

What is your problem?

HARDINGE COMPANY
YORK, PENNSYLVANIA
WORKS AND MAIN OFFICE YORK, PENNSYLVANIA
BRANCH OFFICES
NEW YORK, N. Y., 120 BROADWAY
SALT LAKE CITY, UTAH: NEWHOUSE BUILDING
CABLE ADDRESS HARDINGE NEW YORK

HARDINGE


HARDINGE CLARIFIER
NO OVERFLOW FROM RIM UNLESS CASE IS SPECIAL
SPIRAL SCRAPER REVOLVES ALSO DROPS AN INFINITESIMAL AMOUNT EACH REVOLUTION
SOLUTION AND SOLIDS IN SUSPENSION
SOLID MATTER CAUGHT ON TOP OF FILTER BED AND SCRAPED TO CENTER WITH VERY SMALL AMOUNT OF POROUS FILTER MEDIUM BY SPIRAL SCRAPER
FILTRATE DRAWN OFF HERE
SLUDGE TO WASTE OR OTHER PROCESS

How To Stop Stream Polution

Have you tried to stop polluting the water near your plant? Here is a method which will do two things.

First—Keep you out of trouble.

Second—Save you money either by reclaiming your product, or by giving you a clear water which you can use again.

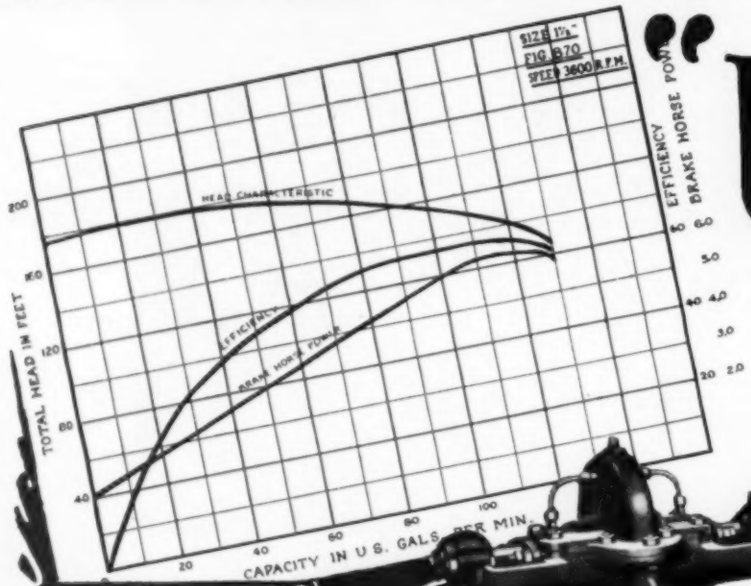
Quantities as small as 10,000 gallons, or as large as 10,000,000 gallons per day can be handled in one machine, continuously, and with practically no attention.

We have helped some very large concerns solve this problem. Can we help you?

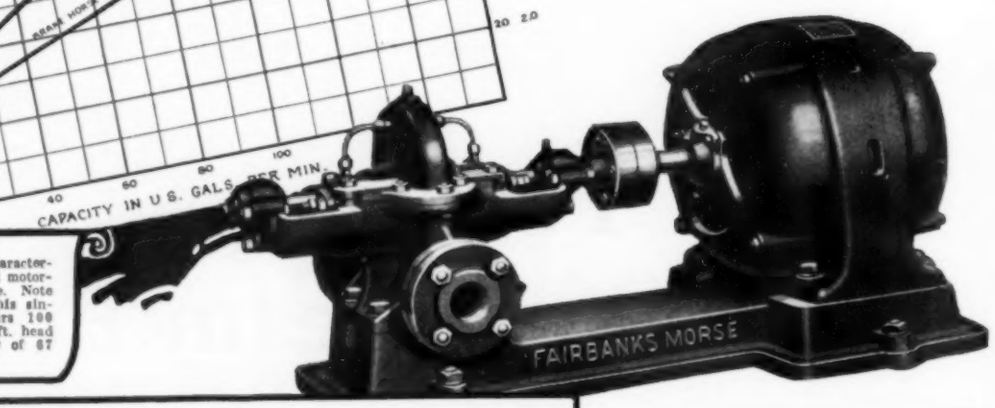
HARDINGE COMPANY
YORK, PENNSYLVANIA
WORKS AND MAIN OFFICE YORK, PENNA.
BRANCH OFFICES
NEW YORK, N. Y., 120 BROADWAY
SALT LAKE CITY, UTAH, NEWHOUSE BUILDING
CABLE ADDRESS HARDINGE, NEW YORK

HARDINGE

"Unit—

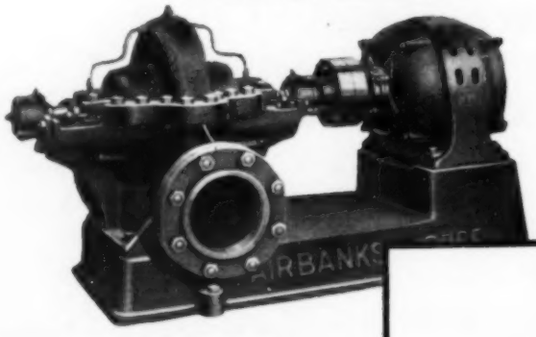


Curves showing test characteristics of the high head motor-pump unit shown above. Note that at 3600 r.p.m. this single-stage pump delivers 100 g.p.m. against a 155-ft. head and with an efficiency of 67 per cent.



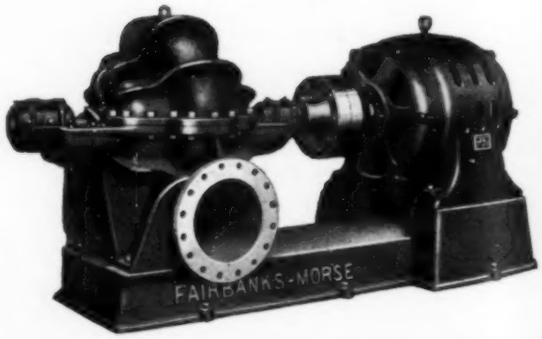
The F-M pump—motor combination for high heads. Every bearing is a *ball-bearing*.

"Unit Built"



Both motor and pump are equipped with ball-bearings and the unit is similar to that illustrated above except that this unit is for moderate head and larger volume requirements.

"Unit Built"



Motor-driven pump with reinforced casing for high pressure service. Sizes to 36 inches.

F M

-Built"
means perfect balance

After all, it is the *overall* efficiency of a pumping unit that counts—the efficiency of *both* pump and power unit.

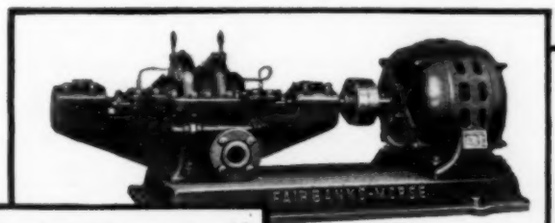
That is the advantage of Fairbanks-Morse unit-built pumping equipment—both pump and driving unit are taken into consideration in the design and are perfectly balanced with each other by Fairbanks-Morse engineers.

An excellent example of this is found in the ball-bearing pumping unit illustrated opposite. Not only the pump, but also the motor driving it, is equipped with ball-bearings. Since Fairbanks, Morse & Company assumes full responsibility for both the pump and the motor you are assured that the combination is exactly suited to the range of service for which it is recommended.

Fairbanks-Morse pumps—centrifugal, steam and power pumps—meet a particularly wide range of pumping needs. Their operating records reflect the unsurpassed facilities of thirty acres of pump factory, and their efficiency attests the wealth of experience accumulated in building successful pumping equipment for practically all industries where pumps are essential.

FAIRBANKS, MORSE & CO., *Chicago*

28 Branches Throughout the United States at Your Service



"Unit Built"

Motor-driven, concentric pattern, multistage centrifugal for heads up to 500 feet.

"Unit Built"

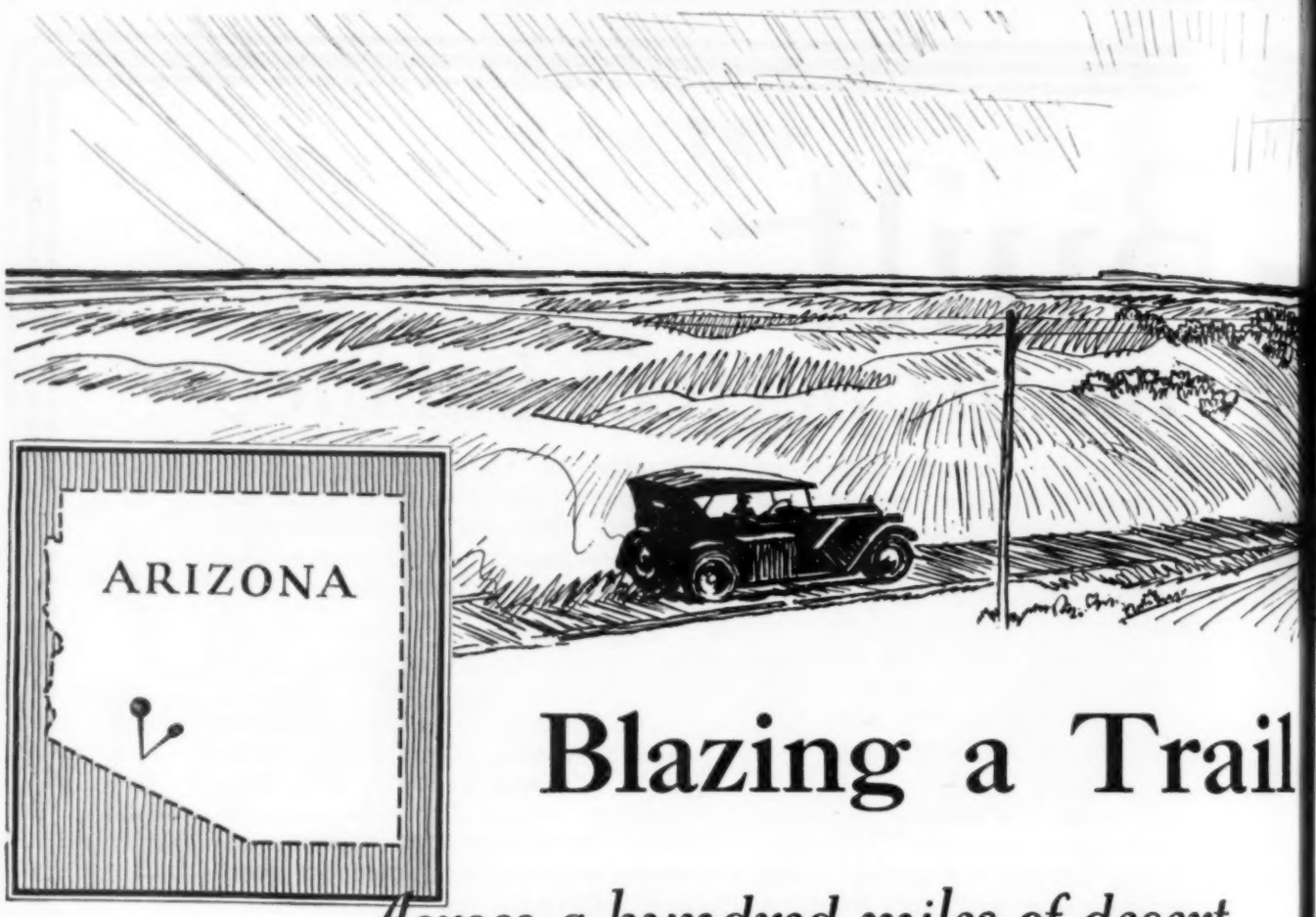
Duplex piston type steam pump for general service. Typical of the general and special purpose steam and power pumps that are included in the F-M line.

"Unit Built"

Motor-driven, volute pattern, multistage centrifugal for heads up to 500 feet.

FAIRBANKS-MORSE
PUMPS · MOTORS · DIESEL ENGINES

APA60.1-1817



Blazing a Trail to

Across a hundred miles of desert

~following the winding trail along wind-swept sand dunes~over corduroy roads~

Puffed and chugged an automobile

IT was taking a McGraw-Hill field man across the Yuma Desert to the only spot in Arizona at which there was a generating station, with as much as 1000 kw. capacity, where a McGraw-Hill Publication was not received and read.

He got his man and back came the laconic report, "Pull that red tack off the map!" . . . . . And out it came.

Red tacks, representing uncovered plants, are getting fewer and fewer on the big map in the McGraw-Hill Publications offices. One by one they come out as McGraw-Hill men, located in every state in the Union, visit the important industrial plants.

A recent analysis of subscriptions to McGraw-Hill Publications in Erie County, N. Y., shows that 80% of industrial buying power in that district is covered—100% in some industries. Erie County is a typical sample of McGraw-Hill circulation throughout the country.

Accepting the responsibility which goes with leadership, McGraw-Hill Publications recognize an obligation to cover their respective fields. Every worth while unit of industry, regardless of location, is a prospect and must be sought regardless of cost.

Your Prospects as well as Ours

The manufacturer selling to industry is striving to make customers of precisely these same units.

The McGraw-Hill Publications

MINING
ENGINEERING & MINING JOURNAL-PRESS
COAL AGE

ELECTRICAL
ELECTRICAL WORLD — JOURNAL OF ELECTRICITY
ELECTRICAL MERCHANDISING

INDUSTRIAL
AMERICAN MACHINIST — INDUSTRIAL ENGINEER
CHEMICAL & METALLURGICAL ENGINEERING
POWER

CONSTRUCTION & CIVIL ENGINEERING
ENGINEERING NEWS-RECORD
SUCCESSFUL METHODS

TRANSPORTATION
ELECTRIC RAILWAY JOURNAL
BUS TRANSPORTATION

RADIO
RADIO RETAILING

OVERSEAS
INGENIERIA INTERNACIONAL
AMERICAN MACHINIST
(European Edition)

CATALOGS & DIRECTORIES
ELECTRICAL TRADE CATALOG — RADIO TRADE CATALOG
KEYSTONE CATALOG (Coal Edition) — KEYSTONE CATALOG (Metal-Quarry Edition)
COAL CATALOG — COAL FIELD DIRECTORY
ELECTRIC RAILWAY DIRECTORY
CENTRAL STATION DIRECTORY
ANALYSIS OF METALLIC AND NON-METALLIC MINING, QUARRYING AND CEMENT INDUSTRIES

to your Customer's Door!

We know they are the same, for they are industry's real buyers. The list of their names is an industrial directory of America. McGraw-Hill records and analyses, compiled through years of research, show the physical rating of the individual plants and their purchasing power.

Subscribers are hand picked in advance on the basis of the positions they fill, from corporation president to the key men responsible for operation and production . . . . . the men who influence or control purchases.

Is your own selling, or your client's selling to these prospects based on pre-analysis of the market . . . . . on accurate knowledge of buying power . . . . . on waste-free selling effort, which result when the *McGraw-Hill Four Principles of Industrial Marketing* are applied? These principles, upon which McGraw-Hill subscriptions are built, are:

MARKET DETERMINATION — An analysis of markets or related buying groups to determine the potential of each. With a dependable appraisal of each market, selling effort can be directed according to each market's importance.

BUYING HABITS—A study of the selected market groups to determine which men in each industry are the controlling buying factors and what policies regulate their buying. Definite knowledge eliminates costly waste in sales effort.

CHANNELS OF APPROACH — The authoritative publications through which industries keep in touch with developments are the logical channels through which to approach the buyer. In a balanced program of sales promotion these publications should be used effectively and their use supplemented by a manufacturer's own literature and exhibits.

APPEALS THAT INFLUENCE—Determining the appeals that will present the product to the prospective buyer in terms of his own self-interest or needs.

We offer to industrial manufacturers everywhere the fruits of our accumulated experience in evolving, proving and applying these Four Principles. At each of the McGraw-Hill offices are Marketing Counselors who will be glad to lay complete data before you or your advertising agent. You can communicate with our nearest office and arrange a consultation, when and where you please.

70 salaried circulation field men cover industry in every state in the Union.
They travel 500,000 miles a year.
220,000 subscribers pay for 10,000,000 copies of McGraw-Hill Publications yearly.
50,000 McGraw-Hill subscribers change their addresses each year, and tell us so.
Only 1 out of every 7,800 copies of McGraw-Hill Publications mailed is returned by P. O. Dept. for better address.
In a year's period 18,000 paid subscribers obtained for Radio Retailing, a record in business paper publishing.

McGRAW-HILL PUBLISHING COMPANY, INC., NEW YORK, CHICAGO, PHILADELPHIA, CLEVELAND, ST. LOUIS, SAN FRANCISCO, LONDON

Mc GRAW-HILL PUBLICATIONS

45,000 Advertising Pages used Annually by 3,000 manufacturers to help Industry buy more effectively.

Let's BUILD

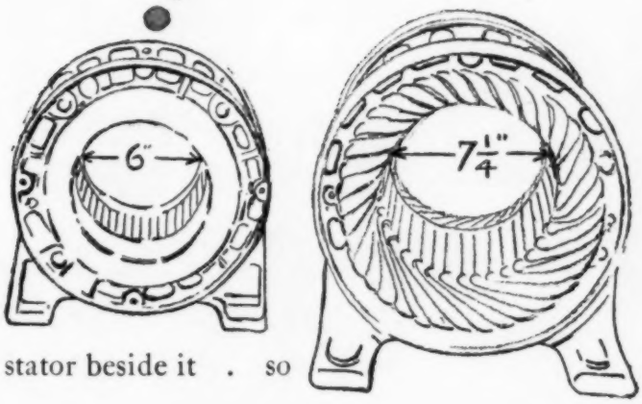
build (5)—to increase and strengthen: to increase the power and stability of: to settle or establish and preserve:
—*Webster*

How to get more motor for the money?

Well, lad, here's the rotor from a well-known 5 hp. motor. It weighs just 29 lbs. There's nothing wrong with that, is there?
TRADITION
PROGRESS
No, Pop . . . .
except that you get only 29 lbs. worth of service from it because the amount of work that a motor will do depends on the amount of laminated iron and copper in stator and rotor. This Linc-Weld rotor weighs 49 lbs. for the 5 hp. and let me sketch out for you how we BUILD (see Webster) more motor for the money.

LINC

a motor! with the Stable-Arc welder



Here is the stator from your motor . . . so

Now look at this Linc-Weld stator beside it . so

Yours weighs 90 lbs. and most of that weight is in the cast iron frame.

The Linc-Weld weighs 100 lbs. and would weigh a lot more except that the frame is of structural steel welded by that production tool, the Stable-Arc welder.

The two elements in any motor that do the actual work are the amount of laminated iron in the fields of stator and rotor and the amount of copper in coils and windings.

Now the harder the iron and copper are worked, the warmer they get—so their weight determines how much of a load can be carried without overheating.

So you see, Pop, in the Linc-Weld you get more of the stuff that does the work—for the same money.

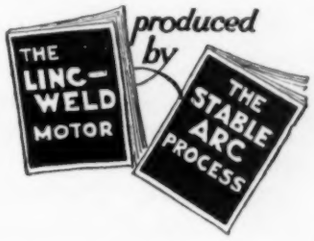
This of course is paid for by the savings made by Stable-Arc welding from structural steel shapes.

Read in the two books how this welder has made a motor that is a couple of years ahead.

The coupon for your convenience.

Illustrated answers

Realizing that the news value of the new process motor, as well as the process by which it is constructed, will naturally bring up many questions—two very completely illustrated volumes have been prepared thoroughly covering the subjects:



These books are in envelopes ready to be sent by return mail to all persons requesting them.

For your convenience in getting your copies—simply pencil in your address on the coupon below.

The Lincoln Electric Co.

Cleveland, Ohio

C-WELD

COUPON

To The Lincoln Electric Co., Cleveland, Ohio

Please send to Mr. .....

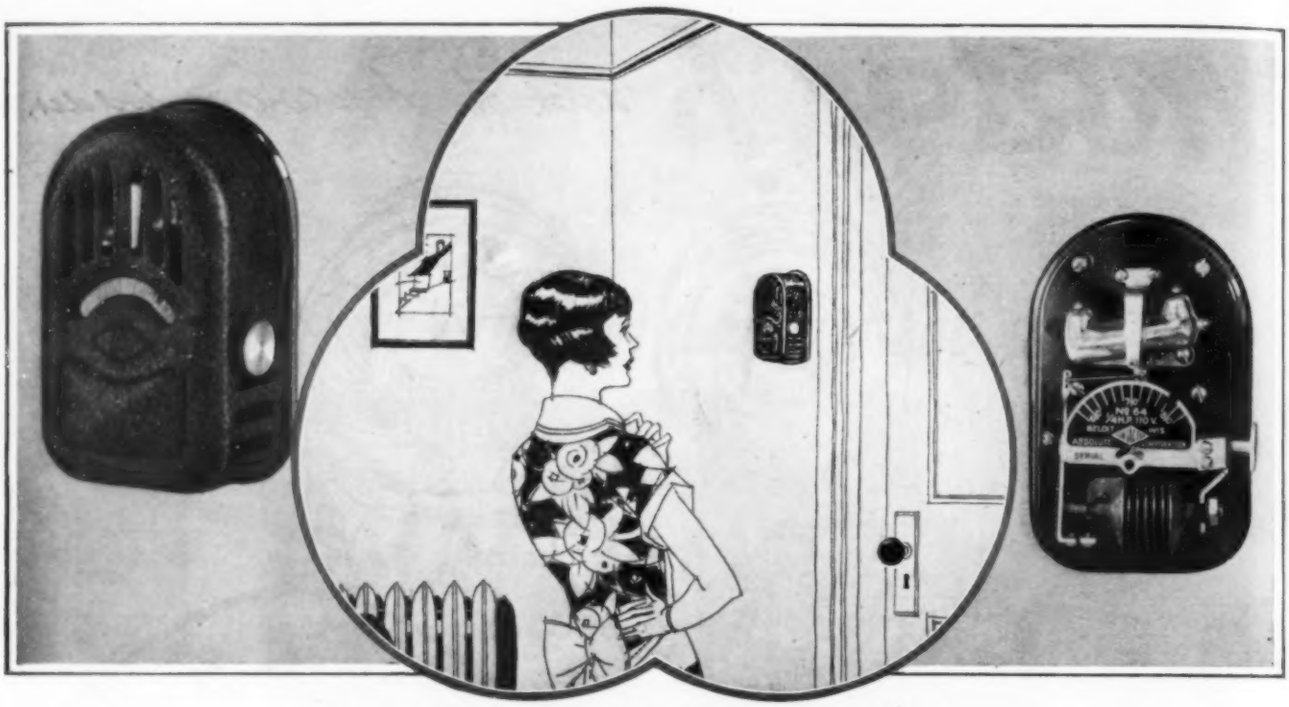
Company .....

Address .....

The Motor Book ☐

The Stable-Arc Process Book ☐

O-6-26



Con-tac-tor Thermoswitch, made by Absolute Con-tac-tor Corporation, Beloit, Wis.

Bakelite provides both thermal and electrical insulation

The accurate performance of the Con-tac-tor Thermoswitch is dependent upon its being unaffected by any temperature variations except those of the surrounding atmosphere. The base upon which the switch is mounted must provide excellent thermal as well as electrical insulation, and molded Bakelite meets the need.

Without Bakelite, the makers say "the design would be almost impossible" and in any other material "the cost would be much higher and its operation much less satisfactory."

The number of devices being improved or perfected through the use of Bakelite is constantly increasing. Perhaps reading our Booklet No. 7, "Bakelite Molded," may suggest some way in which you, too, may benefit through the use of Bakelite. Ask for it and a copy will be sent by return mail.

Bakelite engineers and laboratories are ready to co-operate with you whenever you desire.

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office: 636 West 22nd Street

BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin St., Toronto, Ontario, Can.

BAKELITE

REGISTERED U. S. PAT. OFF.

THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

ANNOUNCING

THAT the Chemical & Vacuum Machinery Co., Inc., have acquired from the Judelson Evapo-Dryer Corporation all rights to build the apparatus known as the

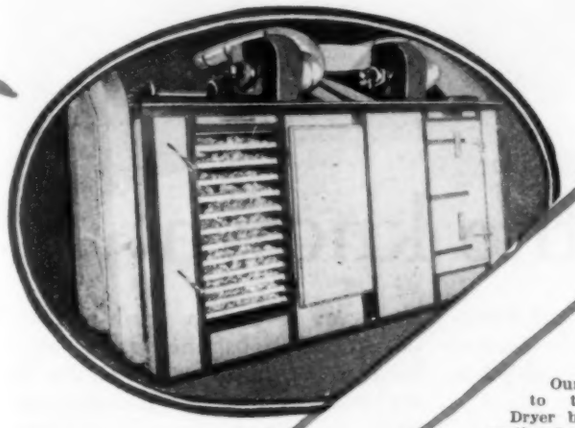
JUDELSON EVAPO-DRYER

under Process Patent 1,527,193, Dryer Patent 1,527,192 and Insulator Patent 1,513,595; and that such manufacturing—together with any servicing necessary to apparatus installed or to be installed—shall be carried on exclusively by the C & V organization.

E. G. Rippel *President*

WILLIAM SCHOELLKOPF, *Treas.*

See at the C & V Plant Demonstration of the Remarkable JUDELSON EVAPO-DRYER

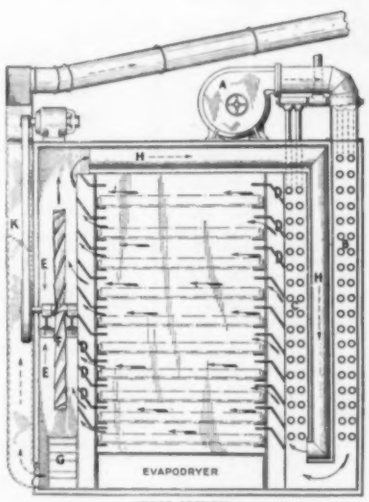


TRAY
TRUCK
CONVEYOR
TYPES

Our attention was drawn to the Judelson Evapo-Dryer by reports of very exceptional showings in a number of Industries. Investigation confirmed these records. In taking over the Judelson Evapo-Dryer, therefore, we do so in accordance with the C & V policy: to present only new or improved equipment which will effect **betterment** in process. We unhesitatingly recommend it, for "tray" or "truck" drying, as the most efficient, most scientific type of apparatus we know of in its field.

The "JUDELSON" positively establishes the required degree of humidity or saturation for drying—which, combined with **balanced distribution of heat units,** PREVENTS CASE HARDENING OR SKIN FORMATION. This further permits the **acceleration of the drying velocity without injury to the materials.**

Maximum utilization of heat—including special and automatic air reconditioning; uniformity of temperature held to any required constant, without thermostat or supervision; more satisfactory and faster drying, with less labor and at lower cost—are among the features we shall be glad to explain to you. Write to—



CROSS SECTION

CHEMICAL & VACUUM MACHINERY CO., INC.

Office, Research and Demonstration Plant, 1602 Main Street, Buffalo, N.Y.

Information worth
Thousands of Dollars
for only $3

HUNDREDS of alert, progressive industrial men have already seized the opportunity—and ordered a copy of the recently announced Industrial Heating Data.

Here are over 225 pages of tables, charts, curves, photographs and graphs; with vital data on furnaces, combustion, burners, processes and materials.

Much of the information has previously been secretly buried in Surface Combustion archives, for the benefit of Surface designers and engineers alone.

Write—now—for descriptive leaflet of this valuable data book—FREE.

Here—
a quarter inch would cost *$1000 a day*

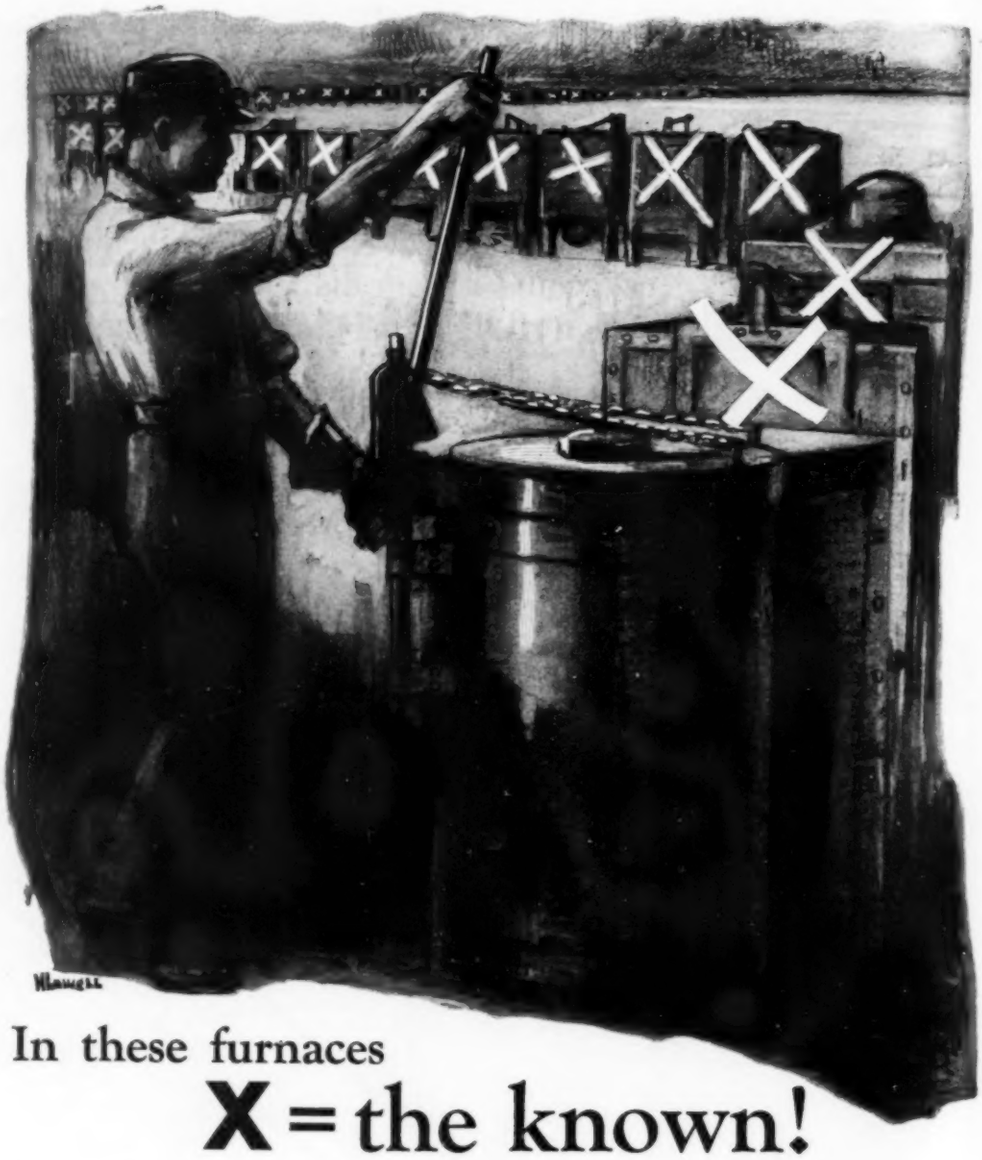
SO closely calculated are the dimensions of Surface Combustion burners that the slightest change on Model 1002, for example, would cost the "_____ Steel Company $1,000 per day in increased fuel.

Design dimensions are dictated by diagrams—not graphed by guess! Every measurement is the result of a decade of research, and the expenditure of thousands of dollars in laboratory experiments.

Thus is explained the fuel economy that cannot be duplicated in the furnace field.

**Name of Steel Company furnished on request.*

Utilization Division
Combustion Utilities Corporation



In these furnaces

X = the known!

THIRTY-ONE models x'd to the yawning scrap pile that the thirty-second might perform well under actual plant conditions.

Not that Surface Combustion does not know how to build furnaces! The rejected furnaces *were* good ones. But the manner in which they applied heat to a certain perplexing manufacturing process had to be studied through repeated experiments until a design was developed which "delivered the goods."

A furnace is simply a vital part of the chain of mass production. Sometimes, as in this case, it is the *application* of the heat to secure a certain finish within close limits that is baffling. And very often, because of lack of precedent, the "cut and try" method must be called into operation until the answer is found.

That Surface Combustion engineers have been unusually successful in the application of heat to difficult manufacturing processes is amply attested by over 18,000 praiseworthy installations—"wherever heat is used in industry."

The Surface Combustion Company, Furnace Engineers and Manufacturers. *General Offices:* 368 Gerard Avenue, Bronx, New York. *Works:* Toledo, O. *Branch Offices in All Principal Cities.*

Surface Combustion

WHEREVER *HEAT* IS USED IN INDUSTRY

Lawtonite

a Better Refractory

"Changes in temperature . . . . . have little effect on . . . . . Lawtonite"—

LAWTONITE Brick exclusively now are used for lining the electric furnaces of the Sherwood Brass Works. These furnaces—which melt brass that is cast into gears, pumps, bushings, valves, automobile parts and other brass products—are operated 9 hours daily, six days a week, 275 days each year (save for time out during relining).

The temperature rises as high as 2000° F. Overnight the furnaces cool down. Changes in temperature which alternately expand and contract the lining, have little effect on Lawtonite. The Lawtonite lining also withstands the wear of charging brass in 25-pound ingots, scrap, gates, etc.—during the four heats of 2000 lbs. each turned out in the 9 hours. Former refractories used, failed to stand up against this hard treatment.

Former refractories lasted only one-third as long as Lawtonite. The cost of the former lining was $1.20 per day or 30 cents per one ton heat. Despite its higher initial price, a Lawtonite lining costs only 73 cents a day and 18 cents per one ton heat. During their life, these Lawtonite linings save on three furnaces about $1,050.00, and about 11 furnace days per year.

AT THE SHERWOOD BRASS WORKS Detroit LAWTONITE Brick have reduced Refractory Cost from $.30 to $.18 per Heat

Write for booklet, "Lawtonite Refractory Facts," which reports the Nielsen Survey on this and other interesting Lawtonite installations.

C. T. Bragg Engineering Co.
11-252 General Motors Bldg.
Detroit, Mich.

F. E. Norris
140 Liberty St.
New York

Geo. P. Delaney
3542 Park Place
Washington, D. C.

James W. Tighe
100 S. Gay St.
Mt. Vernon, O.

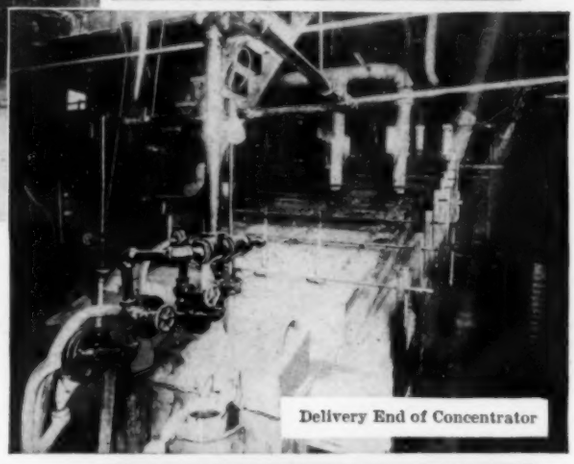
W. H. Pipkorn Co., 712 Park St., Milwaukee, Wis.

LAWTONITE GRAPHITE AND CLAY PRODUCTS TRADE MARK REG. U.S. PAT. OFF.

JONATHAN BARTLEY CRUCIBLE CO.

TRENTON, N.J.

Fume Condensing Equipment



Delivery End of Concentrator

Vitreosil

Continuous Cascade Concentrators

For Producing 66° Bé Sulphuric Acid and Evaporating Non-Volatile Acids and Corrosive Liquids in General

Low Initial Cost and Upkeep

Vitreosil cascade concentrators are moderate in first cost and as vitreosil combines unusual resistance to hot acids and to temperature changes, upkeep and replacement charges are reduced to a minimum. We supply refractory details and asbestos gaskets of proved suitability and also furnish plans for erection, as a part of our service.

Small Fuel Consumption

Less fuel is required to operate a cascade system because it is continuous in operation and is fired by the counter current method. The vitreosil dishes are directly exposed to the fire gases in open seatings, effecting high economy of fuel. Low grade fuel may be employed on account of the complete separation of the fuel gases and the acid and concentrators can be arranged for the use of either coal, oil or gas.

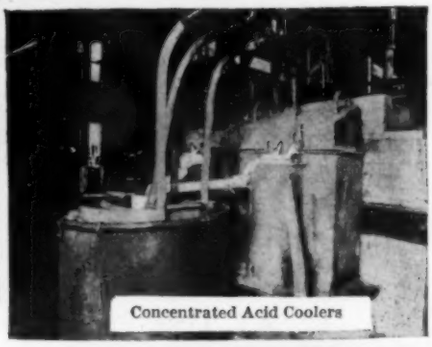
Ease of Operation

Vitreosil concentration units have no complicated parts requiring accurate adjustment, and within their range of usefulness, which is wide, are as nearly "fool-proof" as any form of chemical equipment made. Being simple in construction, they require no expert supervision. Any intelligent fireman who is able to read a hydrometer makes a competent operator for a vitreosil concentration plant. Strength of concentrated acid is readily controlled by regulating acid flow, or fire.

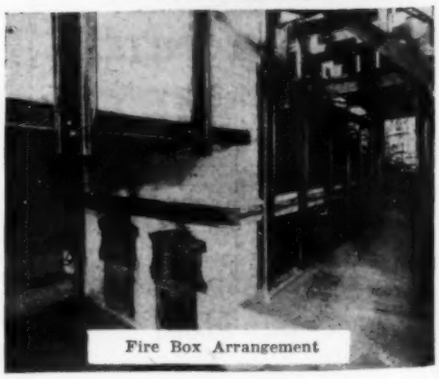
Highest Quality Product

The indifference of vitreosil to chemical action, regardless of temperature or concentration, prevents the introduction of impurities into the liquid under concentration—which leaves the cascade as pure as it entered. Purity of product is further assured by the complete isolation of the concentration and fume chamber from the fire gases.

Sulphuric acid is but one of many chemicals for the concentration of which vitreosil units are admirably adapted. Phosphoric acid—which is exceptionally severe in its action on other materials—is efficiently concentrated in vitreosil, ensuring a product of great purity with the minimum depreciation of plant. Zinc, barium, ammonium and ferric chloride solutions may also be handled to advantage in vitreosil.



Concentrated Acid Coolers



Fire Box Arrangement

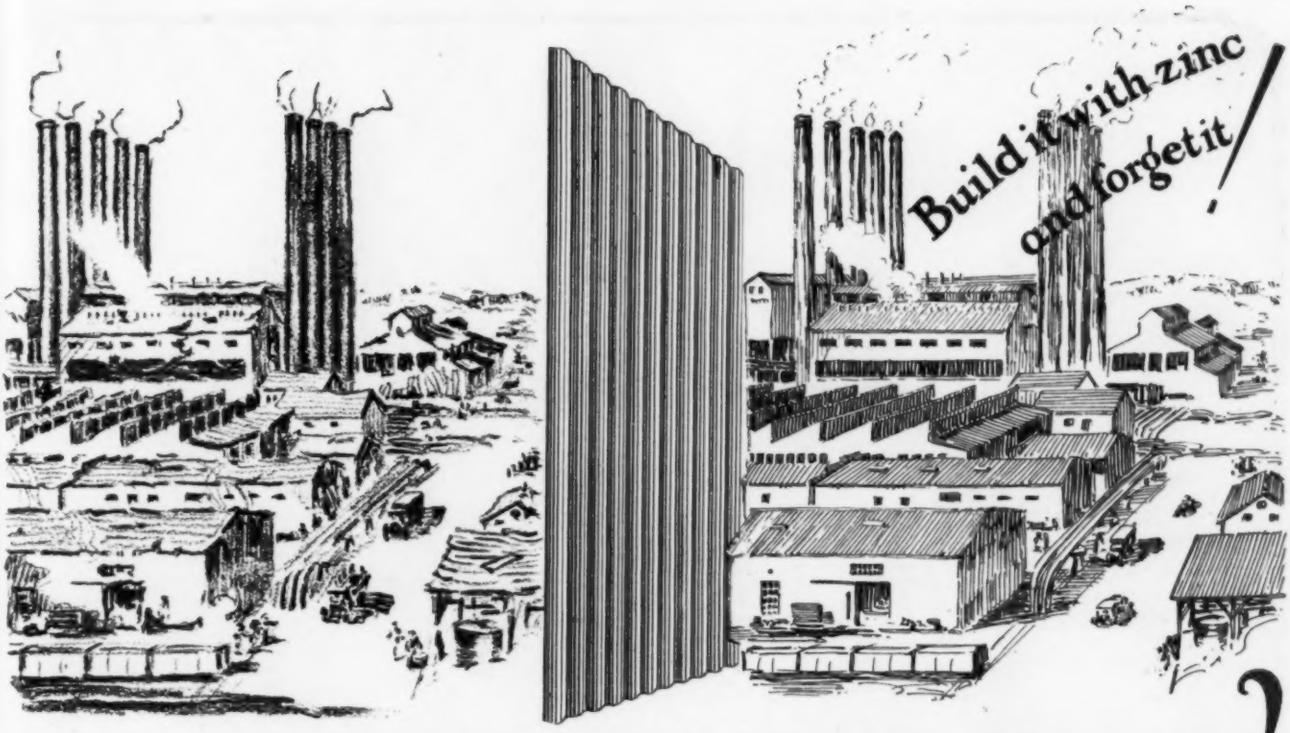
In Extensive Use the World Over

Write for Full Particulars Outlining Your Problem

THE THERMAL SYNDICATE, LTD

64 Schenectady Avenue
Brooklyn, New York

PURE FUSED SILICA
VITREOSIL
Reg. U.S. Pat. Off.
THE THERMAL SYNDICATE, LTD



Are you giving your buildings life-time self protection?

Long before your equipment has finished its useful service, the buildings housing it have been gripped in the talons of corrosion.

Costly industrial equipment needs protection. House it in structures which withstand all agents of destruction—house it in *Corrugated Sheet Zinc—the self-protecting metal* which resists smoke, dust, fire and storms.

And buildings once considered temporary—oil storage sheds, pump houses or any metal structure in and around process industries—are given permanence when you build them of *Corrugated Sheet Zinc.*

To the economy of metal construction, add the self-protecting quality of Zinc. The combination of low first cost with a construction which needs neither maintenance nor repairs, earns for *Corrugated Sheet Zinc* a position of tremendous investment value.

Protect your investment in buildings and equipment. Specify *Corrugated Sheet Zinc* and forget it!

The New Jersey Zinc Company
Established 1848
Products Distributed by
The New Jersey Zinc Sales Company
160 Front Street, New York City
CHICAGO PITTSBURGH CLEVELAND SAN FRANCISCO

Typical process industries where Corrugated Sheet Zinc can be used:

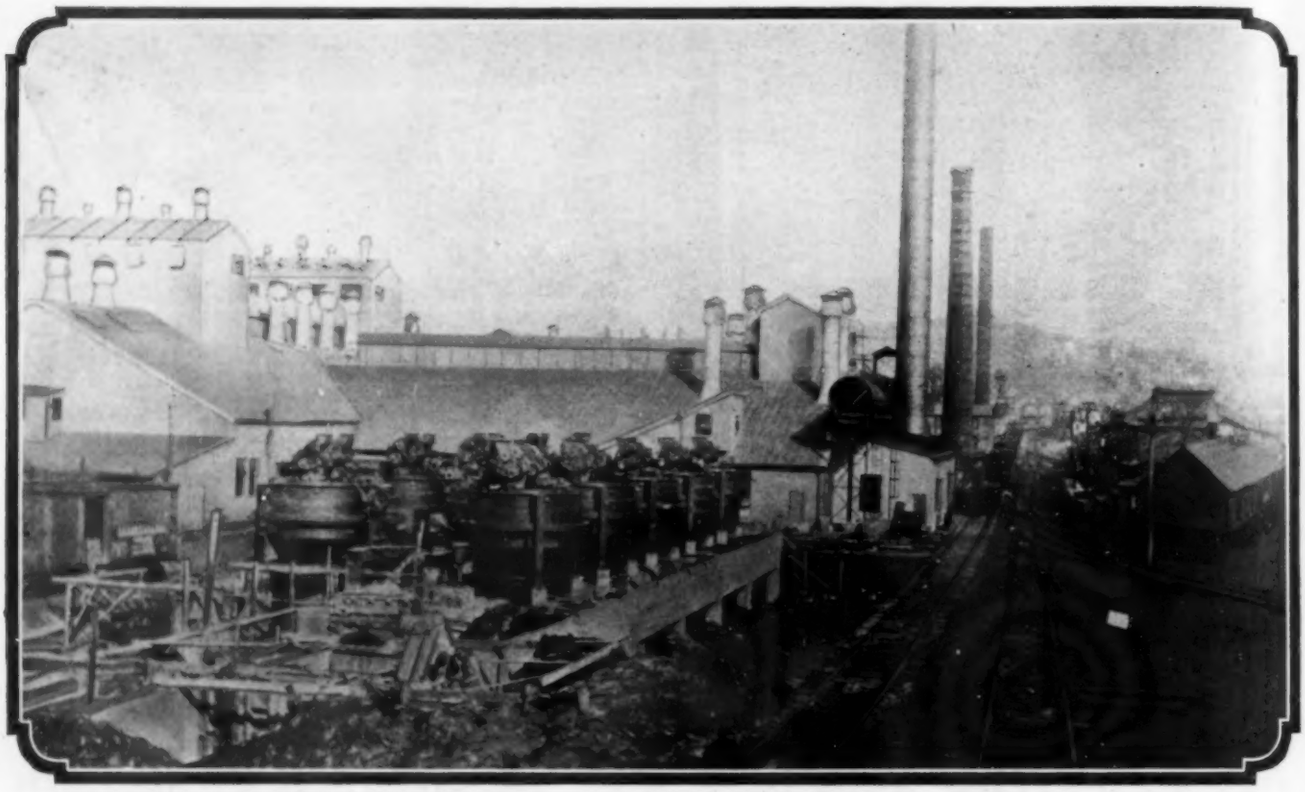
CEMENT AND LIME
Mill Buildings
Covered Rock Storage
Conveyor Galleries
CERAMICS
Storage and Shipping Sheds
COAL PRODUCTS
Conveyor Shafts
Pump Houses
Oven Superstructures
EXPLOSIVES
Buildings
FERTILIZERS
Buildings
Rock Storage
Weigh Houses
FOOD PRODUCTS
Buildings in Canneries
PAINT AND VARNISH
Buildings
PETROLEUM PRODUCTS
Distribution Buildings
Shacks
Pump Houses
PULP AND PAPER
Wood Barking Mills
SUGAR
Structures on Centrales
Refineries

New Jersey zinc

Corrugated Sheet Zinc

THE NEW JERSEY ZINC COMPANY
160 Front Street, New York City
Send me information on the use of Corrugated Sheet Zinc for roofing and siding for:
Type of Building .....
Firm .....
Mr. .....
Address .....
6 C&M

Permanence with high salvage value



Gas Mathematics

and its application to your plant

The subject is one for engineering men to consider seriously.

Costs, quality of product, profits and many other items are directly influenced by Gas Mathematics. W-S-M Engineers through years of experience in work in the Process Industries are able to give you first hand data on the savings effected by our Type L Gas Producer.

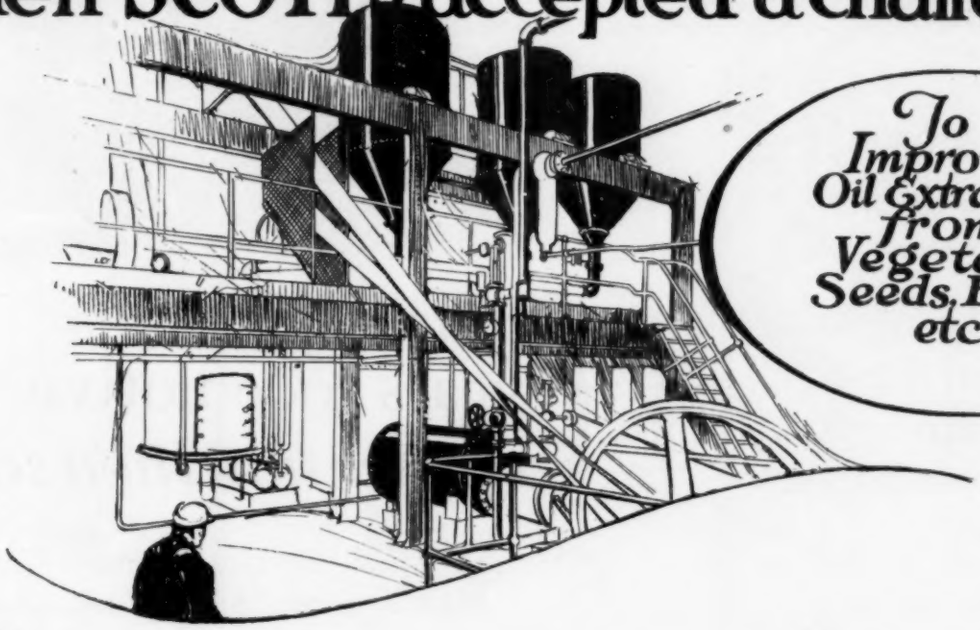
The subject is dealt with in an interesting treatise we have recently published. Send for Bulletin 85.

THE WELLMAN-SEAVER-MORGAN CO.

ENGINEERS CONSTRUCTORS MANUFACTURERS

Cleveland, Ohio

When SCOTTS accepted a challenge



To Improve Oil Extraction from Vegetable Seeds, Beans, etc.

Scott Apparatus

for Evaporation, Extraction, Distillation, Drying and Kindred Processes—

Elimination of Waste

—in these and other industries:

Alkalies
Alcohol
Artificial Leather
Artificial Silk
Beet Sugar
Chemicals
Dyestuffs and Intermediates
Edible Oils
Food Products
Garbage Reclamation
Glucose and Starch
Meat Packing
Paper and Pulp
Petroleum Refineries
Rubber
Soap and By-Products
Tar Products
Fertilizers
Fishing Industry
Textiles

EXPERIENCED engineers and chemists said it couldn't be done! Former equipment and methods employed in this particular Extraction process, had resulted in failure—involving the loss of over one hundred thousand dollars.

SCOTTS believed it *could* be done—and *proved* it through the installation of one of SCOTTS patented processes. The business was established on a practical, commercial scale. Today this Extraction plant capacity has been doubled!

All the old traditions were upset when the special SCOTTS Solvent Extraction equipment went into the plant. It demonstrated conclusively that solvent extraction can be applied to vegetable oils, and can produce therefrom an oil that can be refined and used for edible purposes. Such sources of raw materials as cottonseed, flaxseed, soya beans, copra, castor seed, etc., all are within the scope of SCOTTS service.

SCOTTS Extraction Equipment is highly specialized apparatus—which is built to fit the individual Extraction problem of the user. Yet SCOTTS is surprisingly low in first cost and invariably saves money in the end.

ERNEST SCOTT & COMPANY
Chemical Process Engineers
FALL RIVER, MASS.

SCOTTS

PLANNED PROFITS FROM TRADE WASTE

90 Years of PROCESS Experience

Takes just a moment

CLIP and MAIL

ERNEST SCOTT & CO.,
Fall River, Mass.

I am interested in the following process: .....

Send me information describing new methods, economies and efficiencies.

Name .....

Address .....

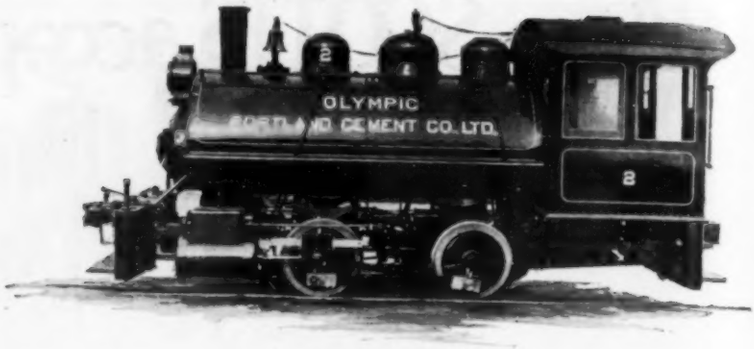
Ask any of these users—*they know!*

Olympic Portland Cement Company

Kosmos Portland Cement Co., Kosmosdale, Ky.
Lawrence Portland Cement Co., Siegfried, Pa.
Lehigh Portland Cement Co., Allentown, Pa.
Louisville Cement Co., Louisville, Ky.
Marquette Cement Mfg. Co., Chicago, Ill.
Missouri Portland Cement Co., St. Louis, Mo.
Monolith Portland Cement Co., Los Angeles, Cal.
National Cement Co., Birmingham, Ala.
National Cement Co., Ltd., Montreal, Can.
Nazareth Portland Cement Co., Nazareth Pa.
Nebraska Cement Co., Superior, Neb.
New Zealand Portland Cement Co., New Zealand
Olympic Portland Cement Co., Bellingham, Wash.

Vulcan Products

Hoists, Electric and Steam
Locomotives, Steam, Gasoline, Electric
Rotary Kilns, Dryers, Coolers and Roasters
Fairchild Double-Discharge Ball Mill
Mine Ventilating Fans
Cages and Skips
Sheave Wheels
Corliss Engines
Coal Crushers
Gray Iron Castings
Open Hearth Steel Castings
Gears, Moulded and Cut Teeth
Special Machinery



14 years locomotive service *and then some!*

At the Olympic Portland Cement Company plant at Bellingham, Washington, a Vulcan Steam Locomotive was placed in service in 1911. This was a 14 by 20-inch cylinder engine.

After 11 years hauling it was found to be as good for work as when new. And as an additional locomotive was needed another Vulcan was selected. The second was a 21-ton with 11 by 16-inch cylinders.

Incidentally Vulcan Kilns at this Olympic plant have a similar service story to tell.

There's no questioning the fact that Vulcan Locomotives and Kilns stand the gaff of long service. Ask any user and send for the Vulcan Steam and Gasoline Locomotive Bulletins.

Don't forget—

we also make *Gasoline* and *Electric* Locomotives.

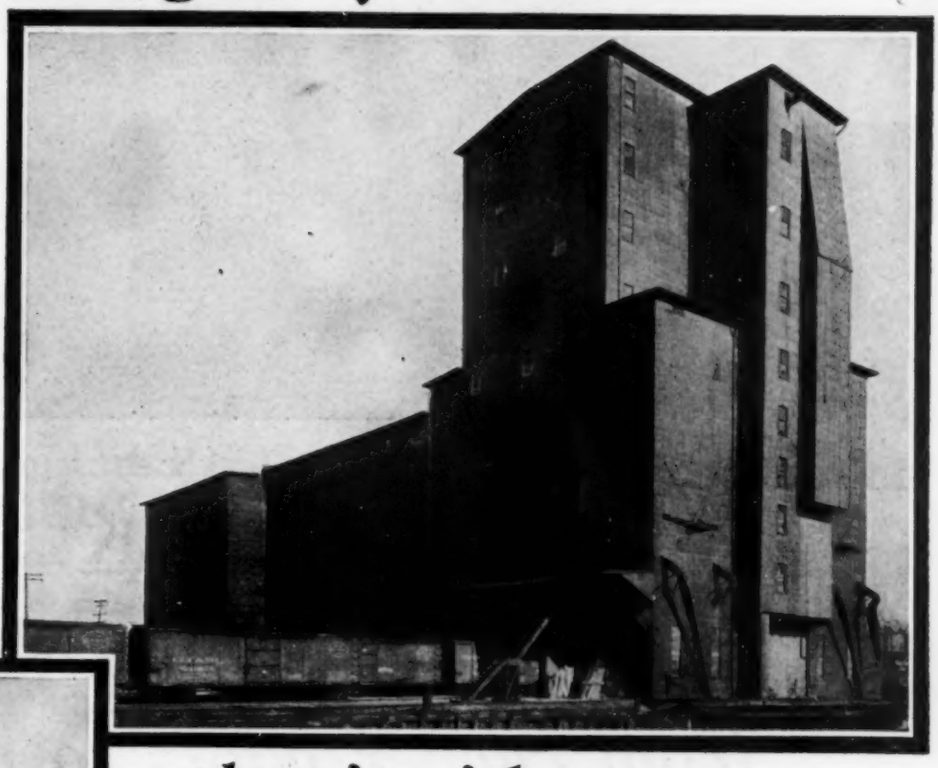
VULCAN IRON WORKS

Established 1849

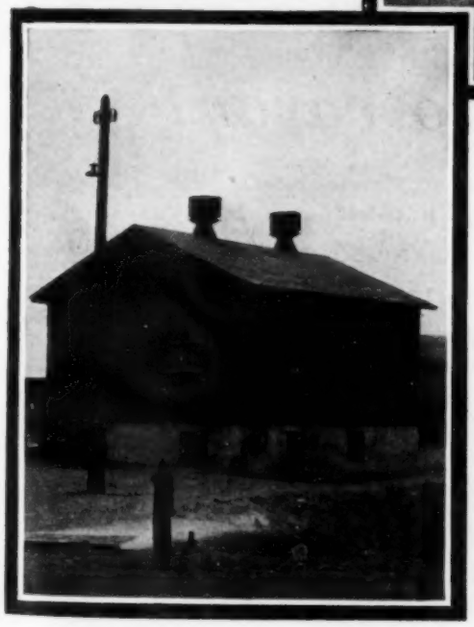
New York 50 Church St. — Wilkes-Barre, Pa. — Chicago McCormick Bldg.

VULCAN IRON WORKS of Wilkes-Barre, Pa. U.S.A.
STEAM GASOLINE ELECTRIC **LOCOMOTIVES**

Your Building May Be BIG--



or it may be SMALL-



but in either case-

—Robertson Protected Metal (RPM) will make the ideal material for your roof and side-walls. RPM roofing and siding sheets—light, strong, prefabricated for immediate application and corrosion-proof—offer you a perfect combination of permanence, easy erection and moderate cost.

Robertson Protected Metal Roofing and Siding is a corrugated steel sheeting made corrosion-proof by three impervious protective coatings (1) Asphalt, (2) Asbestos Felt, and (3) Weatherproofing. It never requires painting. It eliminates the necessity for maintenance and frequent replacement.

Your building may be big—it may be small—but in either case you will want complete information on RPM before making a final choice of covering material. Write us.

H. H. ROBERTSON COMPANY, PITTSBURGH, PENNA.

Branch Offices in Principal Cities

For England: H. H. Robertson Co., Mersey Iron Works, Ellesmere Port, Cheshire.

For Canada: H. H. Robertson Co., Limited,

Offices—Toronto and Montreal. Factory—Sarnia, Ontario

ROBERTSON

Fill in and mail this coupon for catalog and complete engineering data.

Name.....

Company.....

Address.....

City..... **State**.....

CME 6-26

BUFFLOVAK

SPECIAL APPARATUS

from rubber boots to rayon!

FROM rubber boots to rayon; and in other fields just as unrelated, industry has found it both convenient and profitable to use the facilities of the BUFFLOVAK organization for the production of its special apparatus.

These facilities embrace pattern shop, foundry, machine shop, copper shop and plate shop with personnel trained to meet the exacting requirements of BUFFLOVAK apparatus.

Here a piece of equipment may be built precisely in accordance with the customer's specification. Or the resources and experience of both the engineering and research staff are available for the design and development of special apparatus.

BUFFLOVAK
DRYERS AND EVAPORATORS

Atmospheric Double Drum Dryers
Atmospheric Single Drum Dryers
Cabinet Dryers
Hot Air Rotary Dryers, Direct and Indirect heat
Vacuum Drum Dryers
Vacuum Rotary Dryers
Vacuum Shelf Dryers
Calandrias
Inclined Rapid Circulation Evaporators
High Concentrators
Horizontal Tube Evaporators
Pre Evaporators
Vacuum Pans
Vertical Rapid Circulation Evaporators
Vertical Tube Evaporators

BUFFLOVAK
CHEMICAL APPARATUS

Acid Eggs
Autoclaves
Caustic Pots
Causticizing Apparatus
Chemical Castings
Acid Concentrating Pans
Expansion Tanks
Flakers
Fusion Kettles
Nitrators
Nitric Acid Retorts
Phenol Stills
Reducers
Reflux Condensers
Sulphonators

BUFFALO FOUNDRY & MACHINE CO.
1551 Fillmore Ave., Buffalo, N. Y.

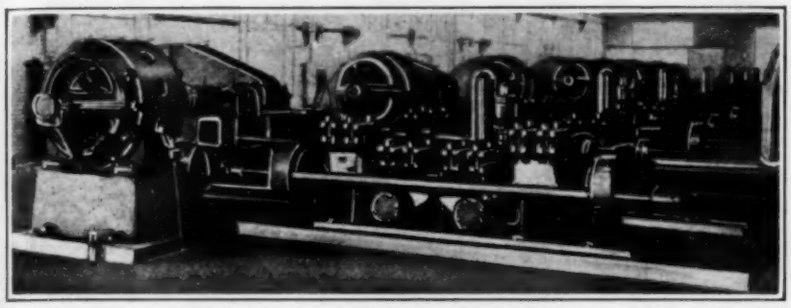
NEW YORK
50 Church St.

LONDON
S. Bornett & Co., 7 & 8 Idol Lane, Eastcheap, E. C. 3

CHICAGO
53 W. Jackson Blvd.

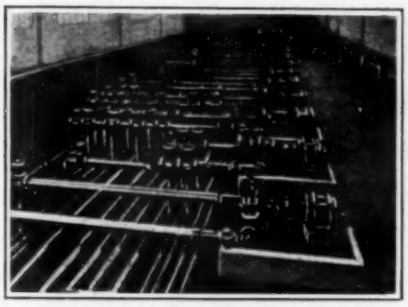
Dryers and Evaporators for every industrial use

GOULDS PUMPS

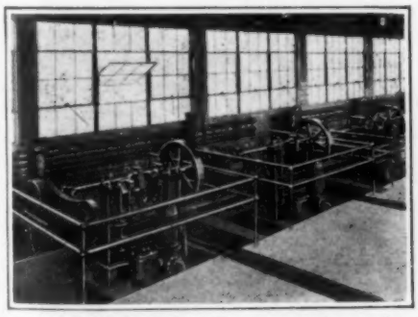


Seven GOULDS Duplex Pumps, Horizontal Double Acting type, electric motor driven, charging high pressure stills in a well-known Refinery.

The Petroleum Industry uses Thousands of GOULDS PUMPS



Eleven GOULDS Centrifugal Pumps handling gasoline and light distillates at the ***Transcontinental Oil Company, Fort Worth, Texas.***



Seven GOULDS Triplex Pumps, pumping crude oil at ***Pure Oil Company***, Newark, Ohio.

The importance of pumping in this industry makes the use of the most dependable pumping equipment imperative.

You will find GOULDS PUMPS successfully handling hot and cold liquids on 24-hour continuous service. These liquids range from the heaviest crude oils to the lightest distillates. Working pressures up to 850 lbs. and temperatures to 600 deg. F. are not uncommon. It takes good pumps to stand up under such conditions, and to maintain a low operating and up-keep cost.

GOULDS Your Convenient Headquarters for PUMPS

There is a type and size for every industrial purpose. For 78 years we have specialized in building good pumps and are in a position to give expert advice on any pumping problem. We will recommend the right pumps for your work.

Chemical engineers are invited to take up their pump problems with us. No obligation. Send the coupon for facts.

PROMPT SHIPMENT

Insured by large stocks carried at our factory and branch warehouses.

GOULDS PUMPS

Centrifugal, Triplex, Rotary, Vacuum, etc. for

Air Washing and Humidifying

Building Equipment Services—including:
- Elevator Service
- Booster Service
- Ice Water Circulating
- Sump Pump Service
- Heating Systems

Construction Work
- Unwatering Excavations
- General Water Supply

Fire Protection

General Water Supply in
- Hotels
- Apartment Houses
- Office Buildings
- Industrial Plants

Irrigation

Mine and Quarry Service

Drainage, Cyanide Mills

Flotation Plants

Refineries

Waterworks, Filtration and Sewage Plants

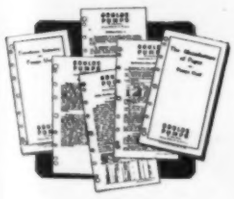
Petroleum Industry
- Oil Pipe Lines
- Oil Refineries
- Natural Gasoline Plants

Process Work—including such industries as:

Coke and Gas—
Chemical—Cellulose—
Paper—Food—Sugar—
Textile

Refrigerating Plants

Steam Power Plants
- Boiler Feeding
- Economizer Service
- Condenser Service
- Fuel Oil



FREE with the COUPON

THE GOULDS DATA BOOKS (Printed by Lefax)

SUBJECTS:

Petroleum Industry
Booster Pumps
Refrigeration
By-Product Coke Ovens
The Manufacture of Paper
Boiler Feeding
Piping
Vacuum Pumps for Steam Heating Systems
Mine Pumps
Hydraulic Elevator Pumps
Motors for Driving Pumps
Extraction Industries
Filtration

GOULDS PUMPS, Inc.
Seneca Falls, N. Y.

90 Branches and Representatives in Principal Cities

GOULDS PUMPS, Inc.
Seneca Falls, N. Y.

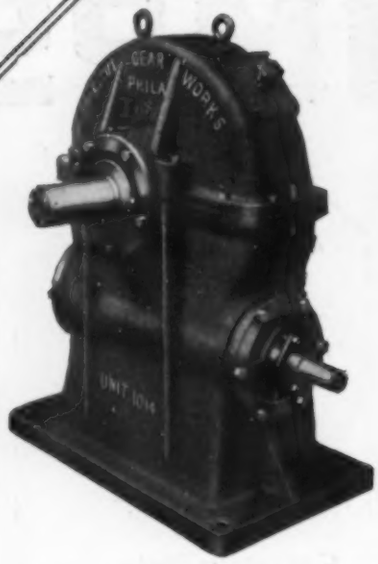
Date.....

Gentlemen: I am interested in pumps for all industrial plant services. Please send me Bulletins and the Goulds Data Books in Le Fax form.

Name .....

Company .....

Address .....



A type AP, size 1014 Philadelphia Worm Gear Reduction Unit. A Right Angle Drive available in most any ratio and for horsepowers up to 250.

Philadelphia Units are the result of over 40 YEARS' GEAR MAKING EXPERIENCE. They are available in Spur, Worm, Herringbone, and Combination Spiral Bevel and Herringbone Types; Straight Line, Right Angle or Vertical Drives.

Philadelphia
SPEED REDUCING UNITS

find many economical uses in the Process Industries

for driving: Mixers, Hoists, Rotary Kilns, Elevators, Crushers, Agitators, Dyeing and Finishing Machines, Grinders, Pulverizers, Water Screens, Pumps, Compressors, Mechanical Stokers, Tumbling Barrels, Line Shafts (for group machine drives),—in fact, wherever an economical reduction in the R.P.M. of Prime Movers is necessary.

ADVANTAGES OF PHILADELPHIA UNITS

Power Conserving, Long Lived, Low in Upkeep Expense, Safe, Silent, Vibrationless, Space Conserving, Minimum Attention Required, Impervious to Acid Fumes, Dust and Moisture, etc.

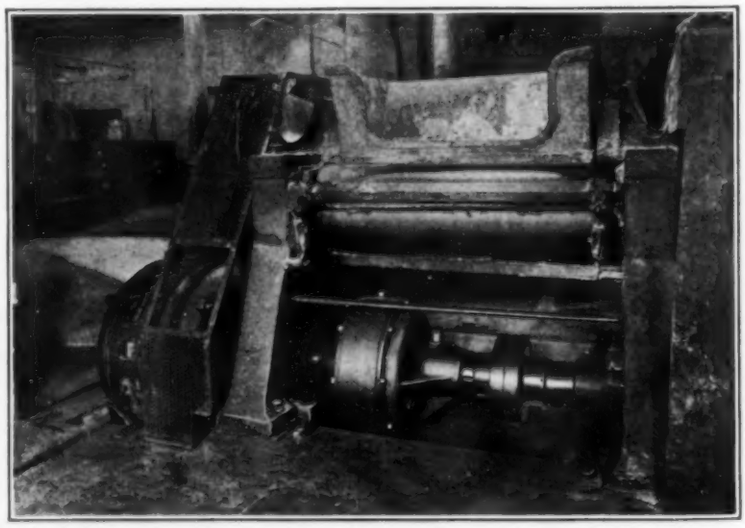


Illustration to the right shows A TYPE R-1 (SIZE 374) PHILADELPHIA SPUR GEAR SPEED REDUCING UNIT; direct connected to a 50 H.P. 1200 R.P.M. Electric Motor, and driving a two roll Calender Mixing Machine in a well-known Linoleum Mfg. Co.'s Plant. The speed reduction ratio is 10½ to 1. NOTE compactness of the Speed Reducing Unit, and that it is occupying NO VALUABLE SPACE.

Main Office and Plant
Richmond and Tioga Sts.
Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

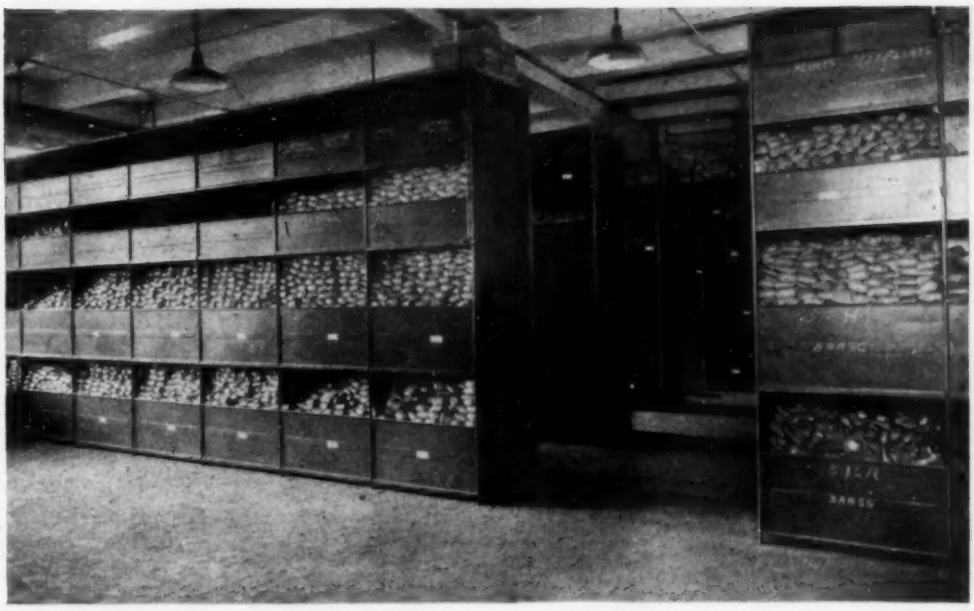
Branch Sales and Engineering Offices: 12 E. 41st Street, New York

How Has Sheet Steel Served You?

Engineers and executives are constantly adapting Sheet Steel to new uses and new products. In doing this, they often gain knowledge which is of far-reaching value and economy to them as well as the public. One of the purposes of the Sheet Steel Trade Extension Campaign is to gather and disseminate knowledge of this character. The Committee is therefore anxious to receive essential data regarding the application of Sheet Steel under circumstances and methods which are new and unusual, and where the practical value of such application has been demonstrated.

Where special work is required to gather this data, we usually arrange for compensation at remunerative rates.

We invite correspondence on any interesting developments as to how Sheet Steel has served you.



Why Sheet Steel Shelving effects such great economy in the storage of material

There are three points that should be carefully considered in making shelving installations:

(1) Racks should be compared from the standpoint of their storage capacity.

(2) The value of the floor space required for each installation should be carefully estimated.

(3) Allowance should be made in reduction of inventory possible through better stock control.

Perhaps the actual experience of an executive will illustrate. This man had built his own shelving. He had plenty of material and labor—apparently the cost was 20 per cent less than the steel, *figuring rack for rack*. Then he outgrew his building. He had to have more space.

An investigation proved that one rack of steel shelving would replace two of the old. The steel was adjustable and put every inch of space to work.

This saving for his storage space solved his building problem so the executive installed steel.

When the installation was complete a check-up of cost proved that while the new equipment, rack for rack, cost 20 per cent more, figured in storage capacity, the saving was 60 per cent.

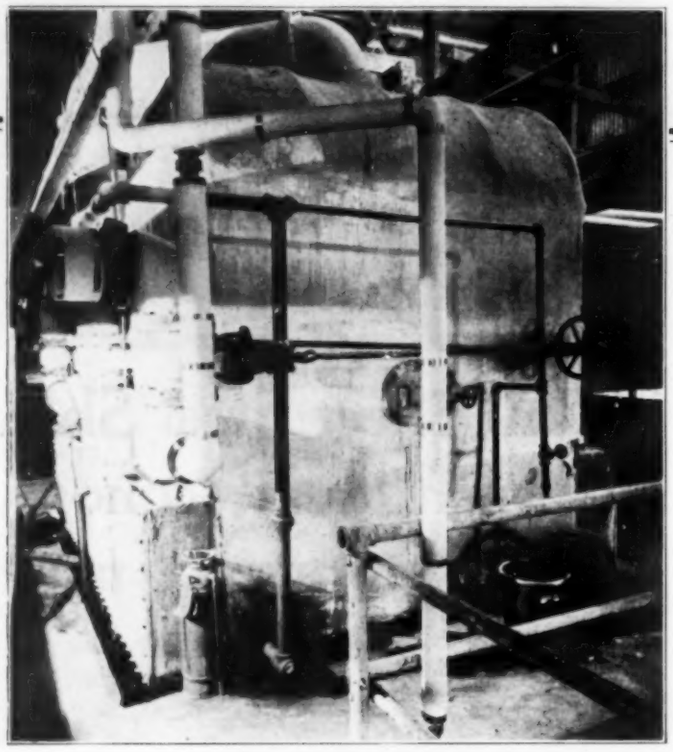
What is more—the flexibility of the new installation permitted much better stock arrangement. Every item had its own compartment in its logical place. This permitted a closer check on stocks, which in turn, made it possible to reduce the quantities carried. The result was the reduction in stock inventory almost offset the cost of the equipment. What is more—expensive shortages and confusion through loss of material, was avoided.

The economies effected in stockroom are typical of savings that can be made in chemical plant operation—from desks to conveying equipment, from steel lockers to complete buildings, wherever durability, permanent beauty and fire resistance are needed it pays to use Sheet Steel.

MASTER TEC BRAND

This trade-mark stenciled on galvanized Sheet Steel is definite insurance to the buyer that every sheet so branded is of prime quality—full weight for the gauge stamped on the sheet—never less than 28 gauge—and that the galvanizing is of the full weight and quality established by the Sheet Steel Trade Extension Committee specification.

SHEET STEEL
TRADE EXTENSION COMMITTEE
OLIVER BUILDING
PITTSBURGH PENNSYLVANIA



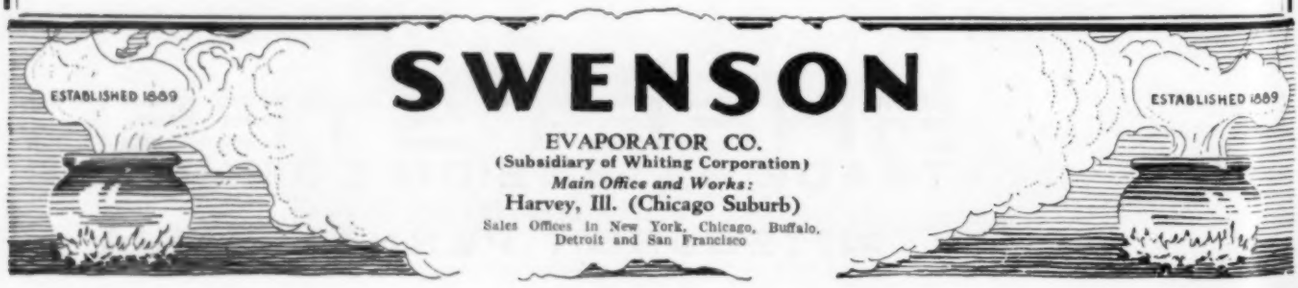
Concentrating Milk Whey

The first Swenson Evaporator used in the productoin of milk sugar was placed in service over twenty-five years ago. Since this initial installation the Swenson Evaporator Company has designed and fabricated practically all of the evaporators used in the concentration of milk whey for the production of milk sugar. Our many repeat orders during this period indicate the confidence of our customers in Swenson design.

The intimate knowledge of this phase of the industry, gained through many years of experience, has enabled our engineers to perfect this equipment to its present high standard. The adaptation of the double effect to this industry in recent years has made possible large savings to our customers.

The illustration above shows such an equipment at the California Milk Products Company.

Your problem may have no relation to the production of milk sugar. Almost every installation involves its own special problems. May we add our experience to your experience in producing the best possible evaporator installation for your conditions?



2ME 6-Gray

The MODERN LIBRARY *of* CHEMICAL ENGINEERING

EARLY in 1923 The Chemical Catalog Company, Inc., established the Modern Library of Chemical Engineering with the object of building up a technical literature dealing with the fundamental processes of chemical engineering. We assumed this task because numerous prominent chemical engineers and operating officials had brought to our attention the fact that so rapid has been the development of the technology of chemical processes in this country during the past decade, the literature on the subject had failed to keep pace.

NATURALLY progress in such a task has been slow. Inevitably technical treatises of any value have to be written by men having many other urgent demands on their time. Consequently, although we have planned for the Modern Library of Chemical Engineering a series of books covering all phases of chemical engineering, only three volumes are available at the present time. The enthusiastic reception that has been accorded these books encourages us to go ahead actively with the completion of the series.

The Books Already Published in This Series are as Follows:

Industrial Filtration.
Arthur Wright, 336 pp.....**$5.00**

It puts on record the author's twelve years of filter experience, and every effort has been made to make the information of practical value.

The construction and operation of all leading types of filtering equipment are treated fully.

Evaporation, Including a Discussion of Heat Transfer.
W. L. Badger, 306 pp.....**$5.00**

A thorough and exceedingly clear exposition of the principles of evaporation and heat transfer. The mathematical treatment of the subject is particularly thorough and lucid.

Evaporation, a Practical Treatise.
A. L. Webre and C. S. Robinson, 500 pp. **$6.00**

Intended particularly for those who have to buy and operate evaporators in the various process industries; detailed consideration of the problems actually met with in plant practice.

OTHER volumes actively in preparation include Fractional Distillation by E. H. Leslie and E. M. Baker; The Elimination and Recovery of Dust and Fumes by James R. Withrow; and treatises on drying, transportation of liquids, compression of gases, mechanical handling of materials, grinding, etc. Naturally such a series as this will never attain completeness, but it is our intention to so advance it that it will adequately reflect the modern development of chemical process technology. We will at all times be glad to hear from authors desiring to submit for publication treatises suitable for inclusion in this series.

BOOK DEPARTMENT

The CHEMICAL CATALOG COMPANY, *Inc.*

19 EAST 24th STREET, NEW YORK CITY, U. S. A.

Built-In Insurance Against Greater Gas Demand

When the inevitable increased demand for gas comes, the operator of Becker Type Combination Ovens is in a favored position, for the assurance of a future supply of over 60% more coke oven gas is built into the Becker Oven.

By substituting blast furnace gas or producer gas as oven fuel, this potential capacity becomes actual production.

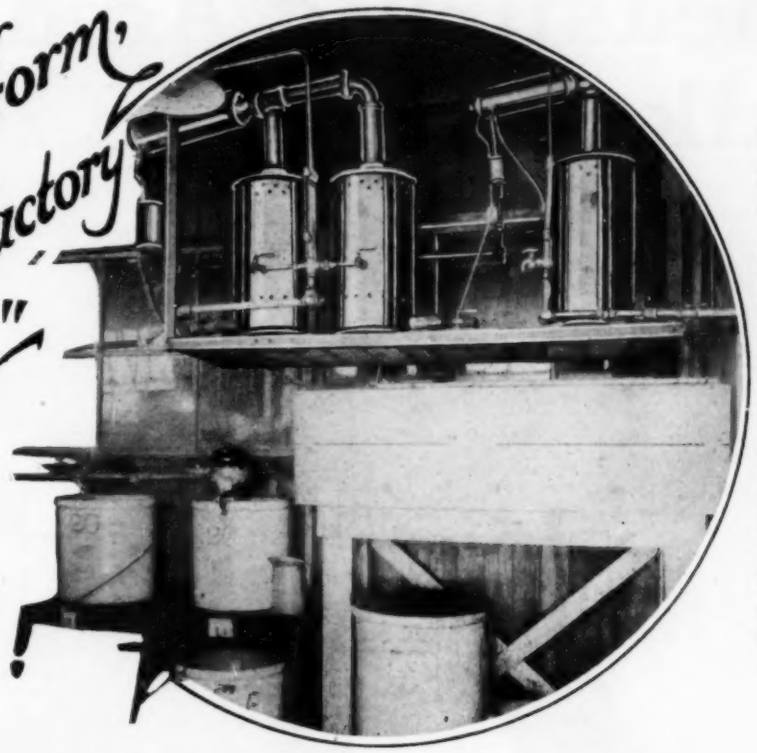
The Iron and Steel Companies buy this insurance in their coke plants for it is one of the most fundamental properties of the Becker Oven. It is the more valuable because no company can say when and to what extent it will need more gas.

The Koppers Company

Pittsburgh, Penna.

Chicago, Ill. **New York City**

"A more uniform, more satisfactory Paper"



A fine installation of a ten-gallon per hour and a five-gallon per hour Barnstead Automatic Water Still, the latter having recently been purchased on the basis of satisfactory performance of the original 10 gal. still.

Operated by a prominent manufacturer of blue print paper, blue print cloth, negative paper and cloth.

The Barnstead-distilled water is employed exclusively in the compounding of the sensitive solutions used in the manufacture of these products. "City" or "tap" water containing suspended or dissolved inorganic and organic matter, and, in this particular case, considerable chlorine from "municipal purification," can be used only with disastrous results.

Chemically pure Barnstead-distilled water assures a "more uniform, more satisfactory paper."

YOU too can have a higher-quality, more profitable product. A BARNSTEAD has the reputation of *bettering the product of every manufacturer who employs it.* Each year adds new enthusiasts to the users of Barnstead-distilled water for plant processes. The truth is being brought home to Industry that not only is Barnstead-distilled water essential to accurate determinations in the plant-control laboratory, but that it also is *an essential basic ingredient of product* or of *process solutions.*

Leading plants in all Process Industries use Barnstead Automatic Water Stills for one reason or another. May we prove to you how a BARNSTEAD can help bring *you* more profits?—without any noticeable increase in your production cost.

Barnstead Still and Sterilizer Co., Inc.
4 Lanesville Terrace, Forest Hills, Boston, Mass., U. S. A.

Write for Free Barnstead Still Hand Book

Note: Mention your daily distilled water requirements and methods of heating available. We manufacture a complete line of models, ⅛ to 100 gallons per hour capacity, for heating by high pressure steam, electricity, gas and kerosene oil. We shall be glad to study your problem and make recommendations concerning either Process or Laboratory Work.

Also investigate our line of Tanks—with Automatic control (if desired) — for the storage of distilled water.

BARNSTEAD WATER STILLS

Barnstead Distilled Water

The Ally of Industry's Leaders

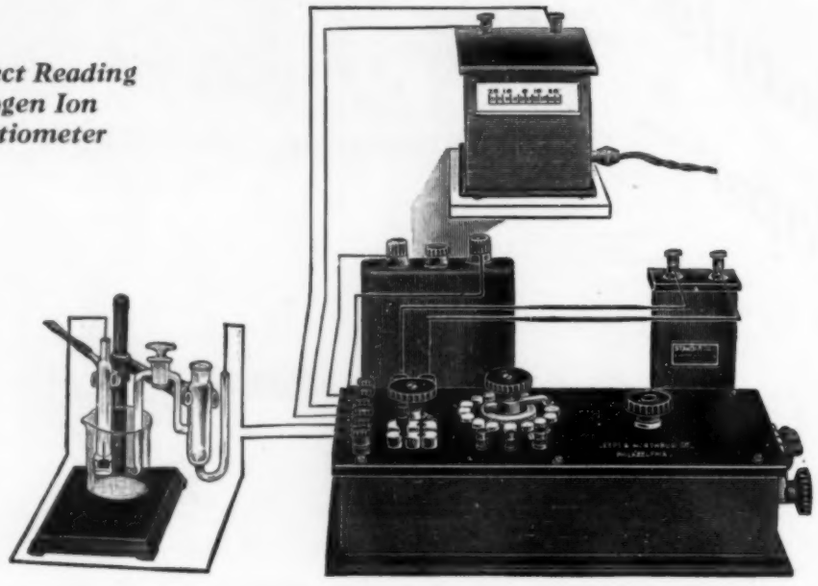
Hammermill Paper Co.
Aluminum Co. of America
E. I. Du Pont de Nemours Co.
American Thermos Bottle Co.
Forhan & Co.
General Chemical Co.
Goodyear Tire & Rubber Co.
National Carbon Co.
Carnegie Steel Co.
General Electric Co.
E. R. Squibb & Sons
Fansteel Products Co.
Loose-Wiles Biscuit Co.
Elizabeth Arden
Procter & Gamble Co.
Hercules Powder Co.
American Radiator Corp.
Westinghouse Electric & Mfg. Co.

and hundreds of other houses that are national "institutions."

Only distilled water is chemically pure

Measuring Acidity or Alkalinity of Liquors

A Direct Reading Hydrogen Ion Potentiometer



Potentiometer Equipment for Chemists

THE potentiometer included in the above equipment reads directly in pH units as well as in millivolts and is of high accuracy, though moderate in price. The hydrogen and calomel electrodes are convenient for use with most solutions to which the electrometric method is applicable.

The assembly shown is suitable for observing changes in acidity, or in alkalinity, under the influence of an agent that effects the reaction and for locating end points in titration.

For more complete description and for applications and prices, consult Bulletin 766-M, which will be sent promptly on request without obligation.

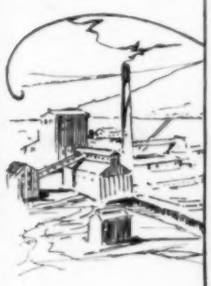
Write for Bulletin 766-M

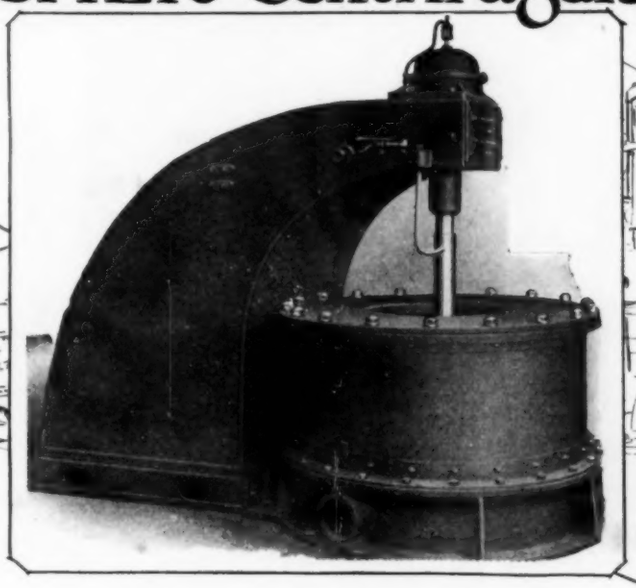
LEEDS & NORTHRUP COMPANY
4901 STENTON AVENUE, PHILADELPHIA

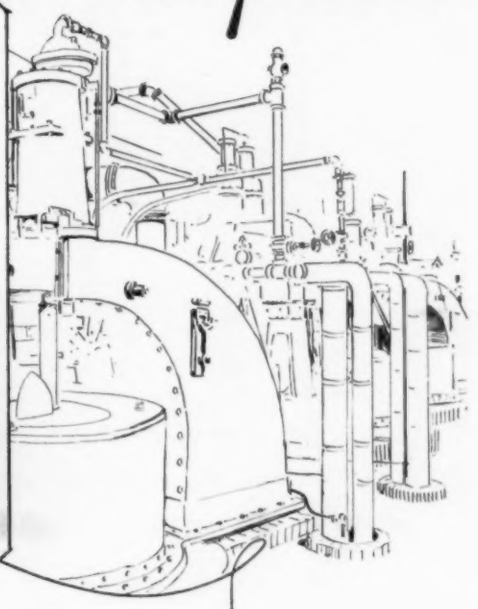
LEEDS & NORTHRUP

FLETCHER Centrifugals Everywhere

in the
By-Product Coke Industry



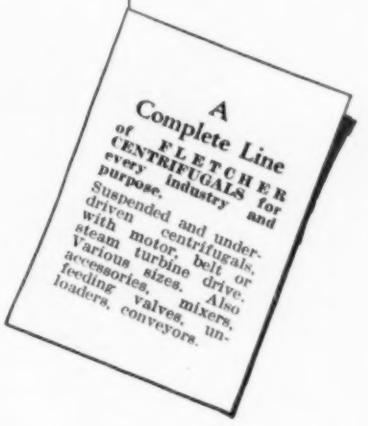




FOREMOST in satisfying the Centrifuging needs of the By-Product Coke Industry, FLETCHER CENTRIFUGALS have been standard in this field ever since the industry began.

Note the ruggedness of the above-pictured Fletcher Centrifugal—a Cantilever Suspended Type, with Bottom Discharge. Centrifuging products such as Ammonium Sulphate involve mighty hard usage. A FLETCHER's strength is built up of a score of details—heavier construction, materials, reinforcements, perfectly balancing basket, self-lubrication—each of which has been perfected through necessary experience, and all going to produce the essential strength and adaptability that mean longest possible life.

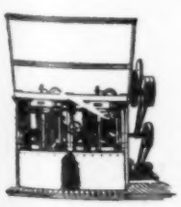
This same Fletcher care and "specialization" are applied to the Centrifuging demands of all other Process industries. Call freely upon our engineers. They will be glad to give you the full benefit of this invaluable FLETCHER experience. They can *insure* the most practical, most effective method of Centrifuging for your particular plant, and probably save you money in the bargain.

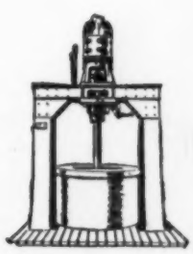


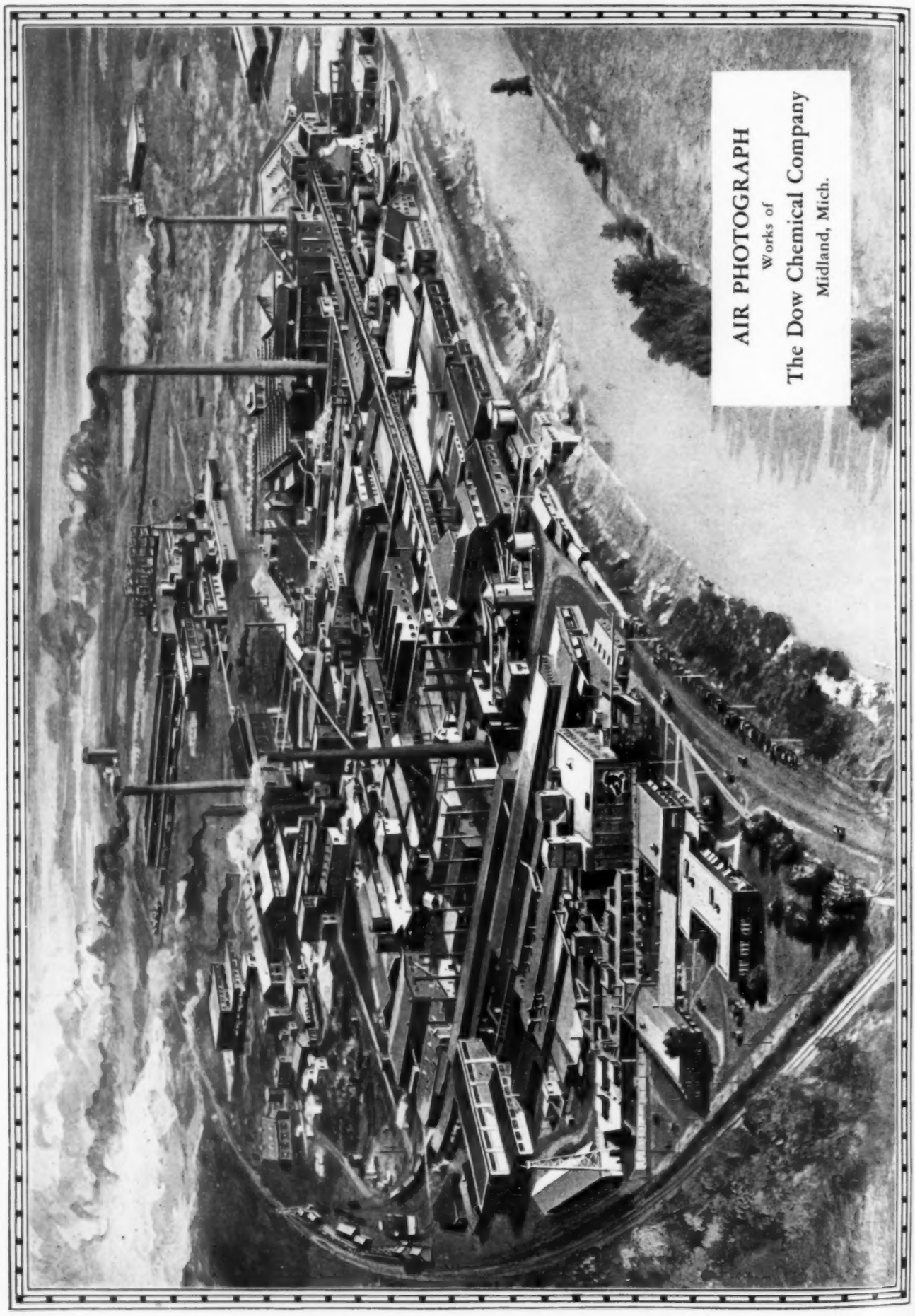
FLETCHER WORKS

INCORPORATED
Formerly SCHAUM & UHLINGER
Glenwood Avenue at Second Street, Philadelphia, U. S. A.
Established 1850

Western Representatives: R. R. Street & Co., 28 N. Clinton Street, Chicago, Ill.
Pacific Coast Representatives: Sharples Specialty Co., 686 Howard St., San Francisco, Cal.







AIR PHOTOGRAPH
Works of
The Dow Chemical Company
Midland, Mich.

Reduced hazards for extraction plants

THE USE of Ethylene Dichloride as an extractive solvent permits the complete recovery of vegetable oils from seeds, without corrosion difficulties and with greatly reduced fire hazard.

The lower explosive limit of benzol, naphtha, gasoline and similar solvents in air is approximately 1.4%. Under similar conditions the lower limit for Ethylene Dichloride is approximately 6% and it is practically impossible to ignite this mixture by a static spark—a factor of great importance in extraction plants.

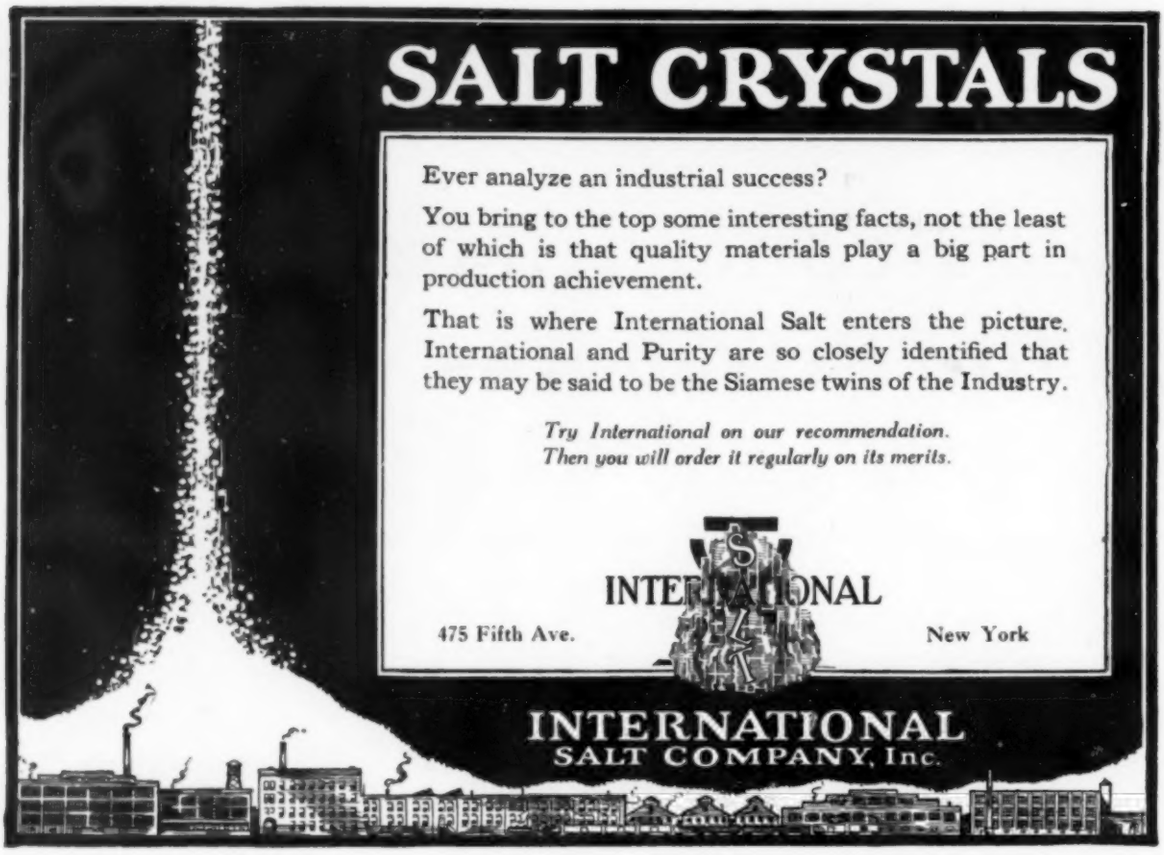
This unusual solvent is worthy of your attention. Let our engineers tell you more about

Ethylene Dichloride

CARBIDE AND CARBON CHEMICALS CORPORATION

Carbide and Carbon Building

30 East 42d Street, New York, N. Y.


SALT CRYSTALS
Ever analyze an industrial success?
You bring to the top some interesting facts, not the least of which is that quality materials play a big part in production achievement.
That is where International Salt enters the picture. International and Purity are so closely identified that they may be said to be the Siamese twins of the Industry.
Try International on our recommendation.
Then you will order it regularly on its merits.
INTERNATIONAL
475 Fifth Ave.
New York
INTERNATIONAL
SALT COMPANY, Inc.

BELLE ALKALI COMPANY
Belle, West Virginia

BELLE BRAND

Liquid Chlorine—99.9%
Cylinders—Ton Tanks—Tank Cars

Caustic Soda—76%
Solid—Flake— in Drums

Bleaching Powder
High Test—Large and Small Drums

Selling Agents
ARNOLD, HOFFMAN & CO.
INCORPORATED
Providence New York Boston
Philadelphia Charlotte

NUCHAR

is highly effective in the treatment of

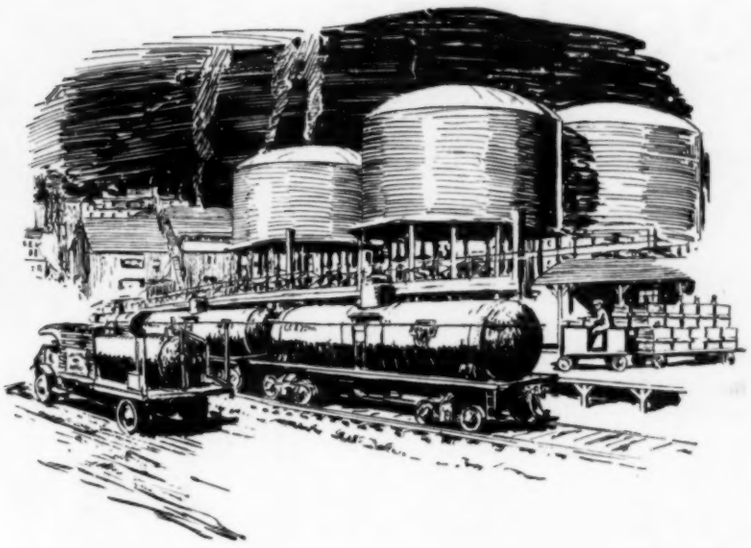
ALKALOIDS
MEDICINALS and
PHARMACEUTICALS

where the maximum purity and whiteness of color is desired at a minimum cost per unit.

We invite correspondence on the application of NUCHAR to your products

INDUSTRIAL CHEMICAL COMPANY
MANUFACTURERS
200 Fifth Avenue, New York

GENERAL CHEMICAL COMPANY



SULPHURIC ACID

OIL OF VITRIOL · OLEUM · MIXED ACID · BATTERY ACID

Among this Company's products are:

ALUMINUM SULPHATE

ACETIC ACID
Commercial, Redistilled
Pure and Glacial

ANHYDROUS
BISULPHITE SODA

GLAUBERS SALT

and other Heavy Chemicals
of Standard Purity

REAGENT CHEMICALS

INSECTICIDES &
FUNGICIDES

It would be difficult to find a process, involving the employment of Sulphuric Acid under any limitations of quality control, in which the use of an acid of Standard Purity will not show the greatest ultimate economy.

Sulphuric Acid as produced by the contact process in General Chemical Company plants meets every requirement. Each year sees the demand for an increasing tonnage. Each year sees plant and distribution facilities expanded in advance of requirements.

GENERAL CHEMICAL COMPANY

40 RECTOR ST., NEW YORK

Cable Address, Lycurgus, N.Y.

BALTIMORE · BUFFALO · CHICAGO · CLEVELAND
DENVER · EASTON · LOS ANGELES · PHILADELPHIA
PITTSBURGH · PROVIDENCE · SAN FRANCISCO · ST. LOUIS

THE NICHOLS CHEMICAL CO., LTD., MONTREAL

GC-181

"Peerless"

WHITE LIME—HYDRATED LIME
PULVERIZED LIMESTONE

Is Yours One of the 150?

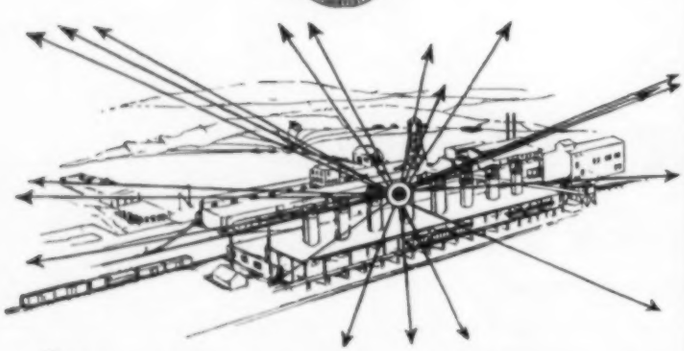
In something like 150 processes and formulas, Chemical Lime of the highest grade has won its place as a preferred basic material.

"Peerless" quality has done much to make this practice standard. This chemical lime of country-wide reputation is obtained from rock free from clay, stain or blemish of any kind. It is prepared in a plant of the most modern design and construction known, and shipped with every possible precaution to conserve all quality.

Explain your Process and let us send you "Peerless" samples for test. No obligation.

"One Ton or a Thousand, Quality Always the Same"

HUNKINS-WILLIS
Lime & Cement Co.
Louderman Bldg., St. Louis, Mo.
ESTABLISHED 1875



The Lime that's shipped the country over!

Let's Find Out

THE Lacquer industry required a chemical compound having certain definite characteristics. The answer was found in Butanol. Since its introduction, the lacquer industry has enjoyed a phenomenal growth, and the production of Butanol has kept pace.

While your product and process may have no connection with lacquer, it is quite possible that Butanol, or some of our derivatives and by-products, may have properties very helpful in your production. Why not investigate? Write us. Let's find out.

COMMERCIAL SOLVENTS CORPORATION

Sales Offices:

17 East 42nd Street, NEW YORK, N.Y.
Aldwych House, Aldwych, W.C. 2, LONDON, ENGLAND
Terre Haute, INDIANA

Plants:—Terre Haute, Ind., and Peoria, Ill.

LIME BUYER'S GUIDE

What To Look For In Buying *Chemical Lime*

6

Many chemical processes demand a hydrated lime of the finest possible texture to guard against the harmful effects of grit, unburned core or dirt in the manufacture of the particular product. Such fineness is in fact, advantageous in any reaction, for quick and thorough results.

FINE TEXTURE

Over 99% of Marblehead "Chemically Pure" Chemical Lime passes through a 200 mesh screen! Imagine a screen almost as fine as a piece of silk and you will have some idea of the fineness of the lime that passes this test 99% perfect.

Every car of our Chemical Lime is sampled and standardized in this way for texture. It is but one of the many rigid tests and inspections that guarantee the user of Marblehead, the highest quality lime possible to obtain for chemical purposes.

Beginning with the high calcium raw limestone, tunneled and calcined under extreme protective measures, and extending through all plant processes, Marblehead is closely guarded and checked at every move.

A trial car will be most convincing. Analysis, samples and booklets on request.

Marblehead Lime Company

CHICAGO ILL. HANNIBAL, MO. KANSAS CITY, MO.

Marblehead Chemical Lime comes in bulk, barrels or as Hydrated Lime in 50 lb. bags.

MARBLEHEAD HIGH CALCIUM WATER SOFTENING CHEMICAL MANUFACTURING **CHEMICAL LIME**

SULPHUR DIOXIDE

ANHYDROUS SO_2

ELEPHANT BRAND

Trade

Mark

ANHYDROUS LIQUID SULPHUR DIOXIDE

"DIOSUL"

is the registered trade mark for the pure Anhydrous Sulphur Dioxide furnished through the wholesale drug houses to the medical profession and is manufactured by the King Chemical Company at Bound Brook, N. J.

In cylinders containing 4 lbs., 40 lbs., 70 lbs., 100 lbs. and 150 lbs., or in tank cars containing 40,000 lbs.

for

Bleaching, Disinfecting, Preserving, Refrigeration and Sulphites

Manufactured by

KING CHEMICAL COMPANY

Main Office and Works:

BOUND BROOK, NEW JERSEY

Cable Address "Chemking" Telephone: Bound Brook 700

Commercial Alum

Liquid Chlorine

Single Unit Tank Cars — *Multi-Unit Tank Cars (1-ton Containers)*

150-lb. Cylinders

Standard Bleaching Powder
Natrona Porous Alum

PENNSYLVANIA SALT MANUFACTURING COMPANY

Executive Offices:

Widener Bldg., Philadelphia, Pa.

Representatives:

New York — Chicago
Pittsburgh — St. Louis

Works:

Philadelphia and Natrona, Pa.
Wyandotte and Menominee, Mich.
Chlorine Distributing Station, Babbitt, N. J.

DARCO

Activated Carbon

For Purifying and Decolorizing Oils, Fats, Waxes, Glycerine, Sugars, Syrups, Solvents and Chemicals

HIGHEST PURITY—LOWEST RETENTION
STANDARDIZED UNIFORMITY
FASTEST FILTRATION

Distributing Points

New York	New Orleans	London
Philadelphia	San Francisco	Rotterdam
Buffalo	Los Angeles	Paris
Chicago	Portland (Ore.)	Tokio
St. Louis	Seattle	Melbourne
Cincinnati	Montreal	Durban, S. Africa

WORKS—MARSHALL, TEXAS
(*Largest Plant of Its Kind in the World*)

Immediate Shipments—Any Quantity

DARCO SALES CORPORATION

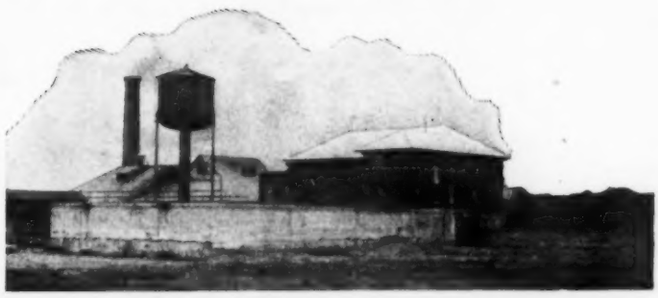
General Offices

Liggett Building—45 East 42nd Street, New York, N. Y.

Telephone "Vanderbilt" 1592-1593 — Cable Address "Darcosale-New York"

Nelco Chemical Lime

of Unusual Value *in* *Water Treatment*



A typical water softening and purification plant.

ONE of the most effective elements in softening and purifying water for general chemical and industrial processes or for boiler feed, is *lime.*

Most hard waters contain the bi-carbonates of calcium and magnesium, and the affinity of lime for carbon dioxide, reduces them to carbonates and thus precipitates them for easy removal.

It is apparent that the more calcium there is in the lime, the more carbonates will be removed, thus quickening the work of softening and purifying the water and doing it at less cost. A *high calcium* lime is the only effective, economical agent for this process—pure, to avoid the introduction of undesirable matter—uniform, to always assure consistent action.

Nelco Chemical Lime, rich in calcium and maintained remarkably pure through unusual protective measures in mining and calcining, is of extreme value for softening and purifying water. Its scientific production under absolute chemical control brings the assurance that every lime buyer should have, of highest chemical activity per dollar of cost.

As in so many other processes—for paper making, leather manufacture, paint, steel, coke, grease and others, Nelco Chemical Lime proves its merit on trial. Write us for anolysis, samples or booklet.

New England Lime Co.
General Offices:
Pittsfield, Mass.

Nelco Chemical Lime comes in bulk, and in steel or wood barrels, ready to use and safe to store.

TRADE NELCO MARK

GRANULAR—HIGH CALCIUM

CHEMICAL LIME

The Best Inert Gas. CO_2. All Uses

Quick Service from Nearby Branches

20 lb. and 50 lb. Drums

"The Liquid" Carbonic Company

Chicago New York Boston Kansas City Pittsburgh Cincinnati Minneapolis Atlanta St. Louis
Memphis Dallas Philadelphia Havana Portland

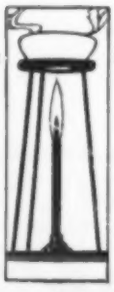
ALKALI

SODA ASH · BICARBONATE OF SODA · CAUSTIC SODA
MODIFIED SODA · SPECIAL ALKALI

Guaranteed Quality Products Manufactured And Sold Direct To Consumer By

DIAMOND ALKALI COMPANY
PITTSBURGH, PA.

Rubber Accelerators
from FURFURAL

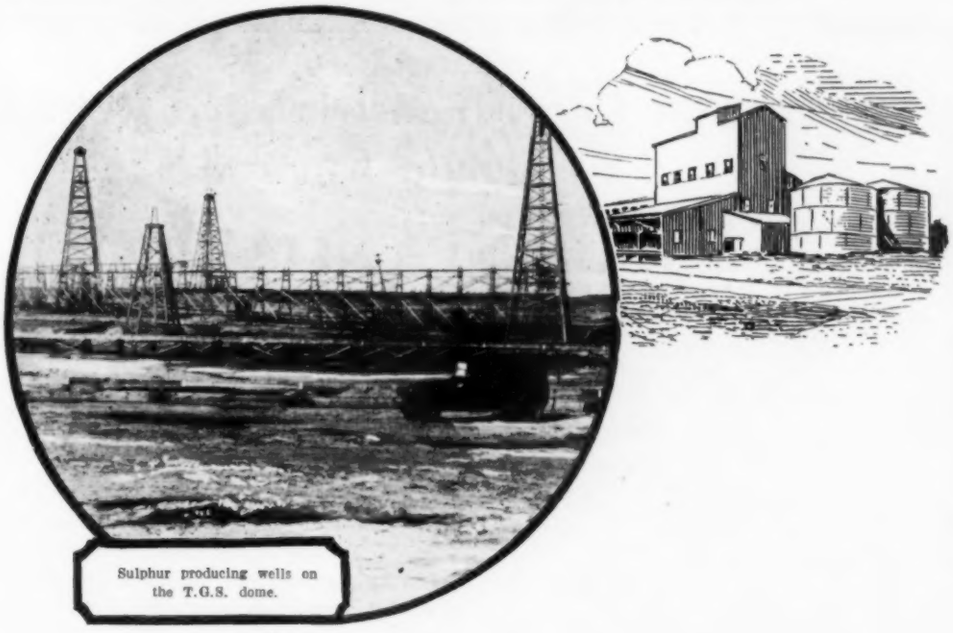


We are now offering hydrofuramide,
Furac I, Furac II and Furac III

Samples and prices on request

THE MINER LABORATORIES, 9 *S. Clinton St.*, CHICAGO

T.G.S. in America's Acid Phosphate Plants



Sulphur producing wells on the T.G.S. dome.

ACID phosphate constitutes about half of the seven million tons of fertilizers used annually. Acid phosphate results from the interaction of raw rock phosphate and sulphuric acid. Efficiency and economy in preparing the sulphuric acid is imperative where the final product is relatively low in price and competition is so keen.

Sulphur, produced by the hot water process at the Texas Gulf mines is especially suited to the requirements of acid phosphate manufacture. The burners occupy small space, require little attention, and a minimum of labor. No special equipment is needed for unloading sulphur. There is no crushing or sizing expense —no residue of cinder to be removed. The use of T.G.S. brings about lower cost and greater tonnage production.

Basil Valentine

in 1475 produced Sulphuric Acid by distilling calcined copperas and silica. His equipment was similar to Ercker's apparatus — illustrated above, as used a hundred years later in the manufacture of Nitric Acid.

We shall be glad to send you a copy of an interesting booklet describing the great T.G.S. mining operations at Gulf.

TEXAS GULF SULPHUR CO.

41 E. 42nd Street New York City
Mine: Gulf, Matagorda County, Texas

Facts that Every Industrial and Research Chemist Should Know About

"SENECA STANDARD" TRIPOLI

What It Is

98% SiO_2. A meta-colloid. Apparent density .685 to .806. Absorption 52%. Specific gravity 2.15 to 2.41. Fusion point approximately 3,300° F.

Present Uses

The base for water-proofed dusts (foundry parting). The mild abrasive base for buffing and polishing compositions and pastes. Filler in hard rubber and similar compositions. Filler and carrier in insecticide dusts.

Grades

Once Ground, a 40 mesh product, approximately 80% minus 200 mesh.
Double Ground, a 110 mesh product, approximately 97% minus 200 mesh.
Air Float, all minus 200 mesh, approximately 99% minus 325 mesh.

Colors

Rose, Cream, Light Cream and Mill Run.

Packed regularly in 200 lb. burlap bags with paper liners; special packages from 1 lb. cartons, up to 300 lb. barrels.

AMERICAN TRIPOLI COMPANY
(Incorporated 1892)
SENECA, MISSOURI, U. S. A.
Subsidiary Barnsdall Corporation

CABLE ADDRESS: Tripoli Seneca CODES: A. B. C. 5th and 6th, Marconi

CATALYTIC ADSORBENT CHARCOALS

impregnated with any metal, oxide of metal, or similar materials can be used for new manufactures or used to improve old methods of manufacture.

Processes and products exclusively licensed under patent rights of Wilson, Whetzel, Pipkin and Barnebey.

Complete equipment installed for conducting processes.

Write to us regarding your requirements

AMERICAN SOLVENT RECOVERY CORP'N
COLUMBUS, OHIO

DIXON'S PAINT

RED LEAD-GRAPHITE PRIMER
ALUMINUM-GRAPHITE
SILICA-GRAPHITE

Consider the high cost of repainting and use one of Dixon's Paints. They will give better protection for exposed metal or wood work at lowest cost and meet the requirements of all specifications.

The pigment, flake silica-graphite, provides a tough yet elastic, film that expands and contracts with heat and cold without cracking or peeling. The graphite and silica are naturally and not artificially combined resulting in long life, efficient surface protection, elasticity and resistance to dampness.

Write for Booklet 243-B "Protective Paint"

JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY, N. J. *Established* 1827

To purchasing agents who buy alcohol —and allied chemicals—*on a basis of price*

ALCOHOL is one of the few products whose production is under absolute government control. By law, its strength and denaturing formulas must pass certain tests, its production must follow certain prescribed methods.

Under the impression that "Government Control" also assures quality of the alcohol itself, many purchasing agents feel that they take no risk in buying from the lowest bidder and make price the determining factor.

In some cases such haphazard "shopping" for alcohol and alcohol chemicals may be satisfactory. But those organizations to whom the supply and quality of these products are most important, have found that real economy demands purchasing *identified* chemicals from manufacturers of recognized standing.

Many of the largest users of these products are steady customers of the U. S. Industrial Alcohol and U. S. Industrial Chemical Companies. They have learned that the resources and facilities of these leading organizations—together with their thorough technical knowledge and practical experience—stand for utmost efficiency and economy in production and in distribution.

* * *

Users of alcohol and alcohol chemicals will find that dealing *direct with these manufacturers* means not only greater dependability, and more efficient service, but complete satisfaction.

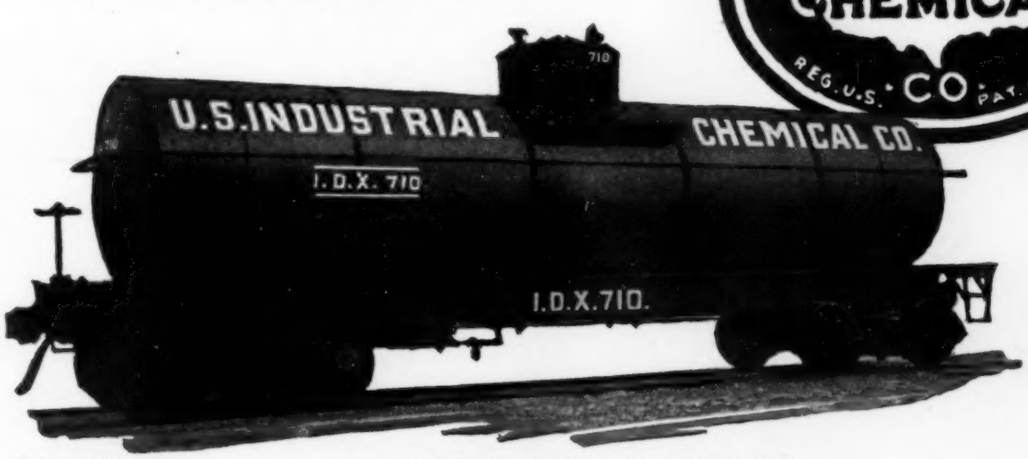
Sales Offices and Warehouses

Boston, Mass.
131 Beverly Street
Buffalo, N. Y.
710 Ohio Street
Baltimore, Md.
119 Cheapside
Chicago, Ill.
3652 Archer Avenue
Cincinnati, Ohio
621 Evans Street
Cleveland, Ohio
507 Perry Payne Building
Detroit, Mich.
1321 Twelfth Street
Kansas City, Mo.
107 North Montgall Avenue
New York, N. Y.
110 East 42nd Street
New Orleans, La.
1008 Maison Blanche Bldg.
Philadelphia, Pa.
141 North Front Street
Pittsburgh, Pa.
916 Bessemer Building
St. Louis, Mo.
828 Gratiot Street

Canadian Agents
Schofield Donald Co., Ltd.
Montreal, Can.

Add to your specifications this trade-mark!

U·S· INDUSTRIAL CHEMICAL CO. REG. U.S. PAT. OFF.



One of the more than 400 company-owned tank cars.

U. S. INDUSTRIAL ALCOHOL CO.

U. S. INDUSTRIAL CHEMICAL CO., INC.

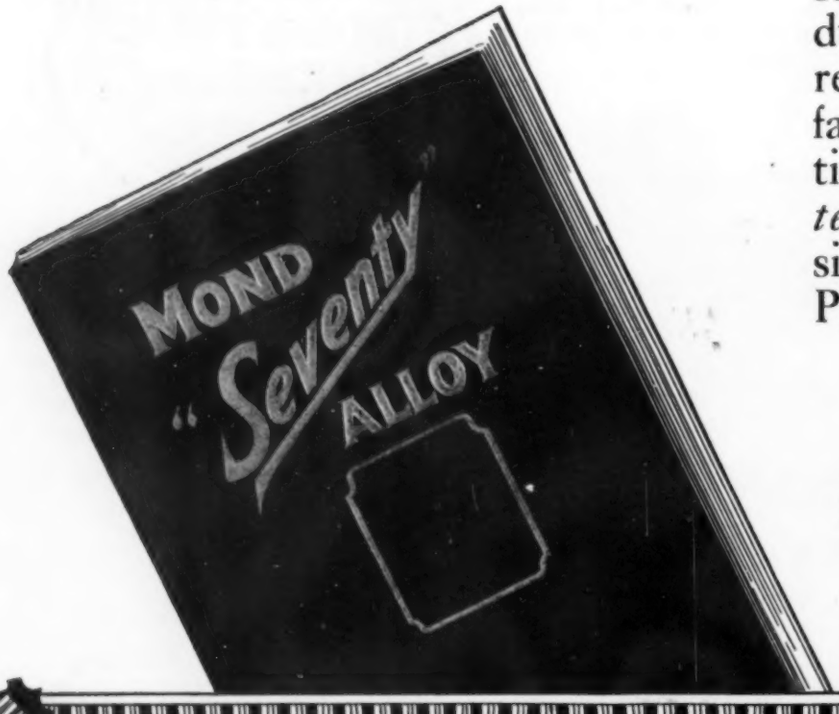
Executive Offices: 110 East 42nd Street, New York

...moreover, at reasonable

	Type of Metal	MOND "SEVENTY" ALLOY					
	Period of Corrosion Hours	50	100	200	300	400	500
	REAGENT						
Mineral Acids	1% Nitric Acid	.046	.070	.104	.137	.167	.193
	1% Hydrochloric Acid	.029	.045	.073	.110	.136	.223
	10% Hydrochloric Acid	.040	.065	.120	.189	.256	.325
	1% Sulphuric Acid	.014	.026	.047	.072	.099	.125
	60% Sulphuric Acid	.010	.012	018	.026	.033	.040
Organic Acids	1% Acetic Acid	.021	.036	.064	.087	.112	.134
	10% Acetic Acid	.026	.046	.078	.110	.140	.169
	5% Tartaric Acid	.017	.027	.049	.064	.080	.093
	5% Citric Acid	.021	.032	.055	.076	.094	.110
	5% Lactic Acid	.015	.028	.055	.083	.107	.128
	5% Malic Acid	.013	.023	.043	.062	.078	.093
	2% Tannic Acid	.013	.020	.030	.041	.052	.059
Alkalies	10% Ammonia Solution	.040	.063	.123	.275	.298	.299
	5% Caustic Soda	Tr.	Tr.	.0002	.0003	.0004	.0005
	5% Caustic Potash	Tr.	.0001	.0002	.0004	.0006	.0007
	10% Sodium Sulphur (Commercial)	.0003	.0003	.0004	.0004	.0005	.0005
	10% Sodium Carbonate and Little $NaHCO_3$	.0042	.0051	.0065	.0076	.0086	.0092
Neutral Reagents	Distilled Water	Nil.	Nil.	Nil.	Nil.	Tr.	Tr.
	Sea Water	.0020	.0030	.0045	.0053	.0060	.0067
	1% Sodium Chlor	.0011	.0022	.0030	.0033	.0035	.0037
	10% Sodium Nit	Nil.	Nil.	Nil.	Tr.	Tr.	.0002
	10% Potassium Nitrate	Nil.	Nil.	Nil.	Tr.	Tr.	.0003
	10% Cyanide, Double 98% Salt	.023	.040	.072	.104	.136	.168
	5% $CuSO_4 5H_2O$, ¼% H_2SO_4	.025	.037	.064	.096	.123	.146

Study These Corrosion Figures

Results obtained by immersing weighed portions of hard, cold-rolled "Mond Seventy" Alloy having an area of 0.6 square decimeter, in different reagents contained in glass-stoppered bottles and kept at room temperature of 15°-20° C. After the various periods of immersion, the pieces of metal were removed, dried and weighed. From the loss in weight the amount of corrosion that would have taken place with 1 square decimeter of surface was calculated.



Under Control *of* SCIENCE

MOND "SEVENTY" Alloy is produced with *actual uniformity*—impurities and irregularities in composition are eliminated—thus affording a nickel-copper alloy which is never erratic in behavior and which possess many of the most valuable and useful characteristics known to engineering industries.

It combines high tensile strength with malleability, ductility, toughness and resistance to shock. The fact that its tensile qualities are *preserved at high temperatures* is of greatest significance to many a Process plant.

Write for this Free Guide

to Mond "70" applications in Process industries. It describes Mond advantages by the use of which your plant probably can benefit.

American Nickel Corporation
CLEARFIELD, PENNA.

e price—

All Ingredients of this Alloy

Nickel about.....70%
Copper about.....26%
Manganese..... 4%

are
Scientifically Controlled
and
produce an Ideal Material
for
Exacting Applications

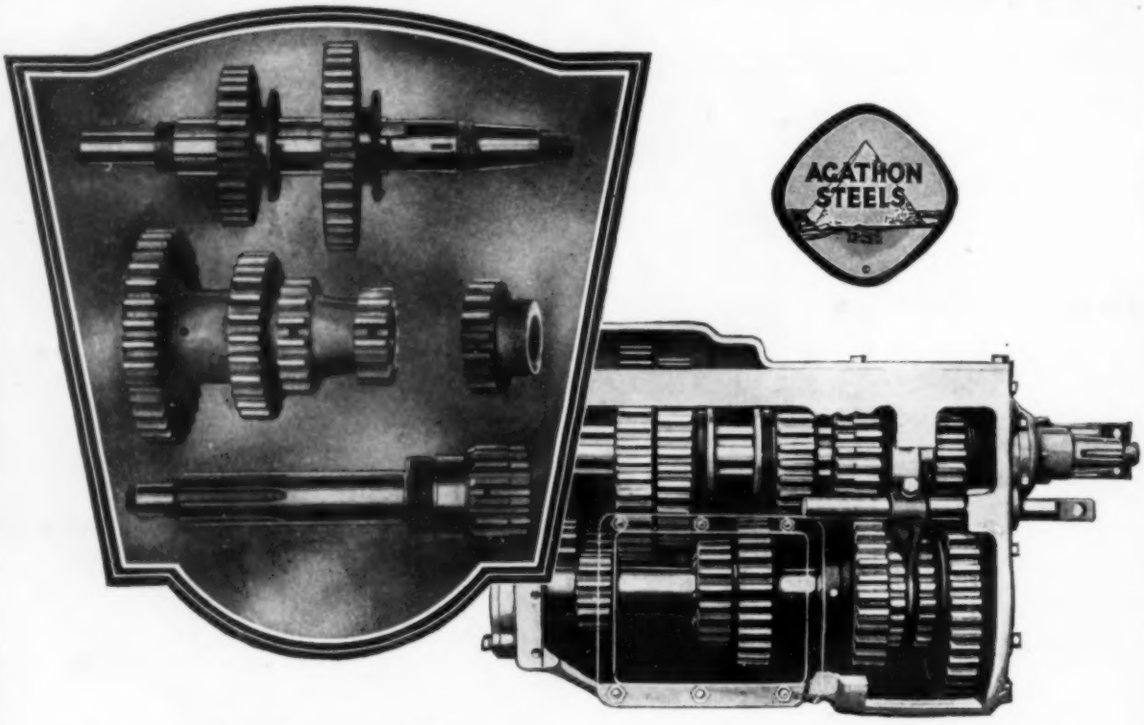
Resistance to corrosion, erosion, oxidation, abrasion and acid, are among Mond "Seventy" Alloy's recommendations. It is specially resistant to the action of ammonia, either in its aqueous solution or as a gas; to caustic alkali or carbonate solutions; to all alcohol and alcohol-containing substances. Mond "Seventy" also is an exceedingly useful electrical-resistance material.

This remarkable alloy is obtainable in all commercial forms. Special equipment fabrications can be supplied to your order.

An important feature is the *very reasonable price*—the first time, to our knowledge, that such uniformity in composition and structure, together with other high qualities, could be had at such low cost for exacting Process requirements.

AMERICAN NICKEL CORPORATION
CLEARFIELD, PENNA., U.S.A.

Exclusive Representatives for the Mond Nickel Company, Ltd.



Steel for Transmission Gears

Our UMA No. 5 is a special purpose steel, designed to meet particular conditions. It is confined to a narrow range of analysis and produced with the idea of ultimate use in parts requiring a dense, uniform, hard steel.

It can be annealed in continuous furnaces of proper design, to desirable hardness and structure, in a few hours, and in batch furnaces in relatively short periods. It is, therefore, the most desirable of our UMA series for production of large quantities of automotive transmission gears.

UMA No. 5 is the most suitable of the UMA series for hard, tough service such as shear blades, hammers, dies, rolls, and all places where hard surfaces must be backed up by maximum strength and toughness.

Upon request, we will send a copy of our Agathon Alloy Steel handbook giving details and charts covering the entire series of UMA steels—made *only* by us.

We also have daily production in all kinds of Agathon Alloy Steels such as—

Nickel, Chrome-Nickel, Molybdenum, Chrome-Molybdenum, Nickel-Molybdenum, Vanadium, Chrome-Vanadium, Chromium, etc.

Deliveries in Blooms, Billets, Slabs, Hot Rolled, Heat Treated, and Cold Drawn Bars, Hot Rolled Strips, etc.

THE CENTRAL STEEL COMPANY, Massillon, Ohio

Swetland Bldg., Cleveland — Book Bldg., Detroit — Peoples Gas Bldg., Chicago
Aeolian Bldg., New York — University Block, Syracuse — Widener Bldg., Philadelphia
303 W. P. Story Bldg., Los Angeles, California

UMA-No 5
ALLOY STEEL

"CIMET" RESISTS

Alcohol
Acetic Acid
Acetone Vapor
Aerated Water
Ammonia Liquor
Ammonium Hydroxide
Ammonium Nitrate
Apple Juice
Azol
Beer
Benzene
Benzol
Bleaching Solution
Blood
Boric Acid
Brewing Materials
Calcium Hypochlorite
Cane Sugar Molasses
Carbolic Acid
Caustic Soda Solution
Chocolate
Cider
Citric Acid
Claret
Coal Mine Waters
Copal Varnish and Graphite
Cylinder Oil
Drains
Ethyl Chloride
Formaldehyde
Formic Acid
Fruit Juices
Gasoline
Glycerine
Hydrokinone Developer
Inks (some)
"Kodak" Developer
Lactic Acid
Lemon Juice
Lime and Limestone (Emulsion in water)
Liqueur Brandy
Lubricating Oils
Lysol
Malic Acid
Mercuric Cyanide
Mercuric Iodide
Metal Mine Waters
Milk (Fresh and Sour)
Nitric Acid
Novocaine
Oleic Acid
Onions
Orange Juice
Oxalic Acid
Ox Blood
Paraffin
Petrol
Port
Potassium Carbonate
Potassium Cyanide
Potassium Nitrate
Potassium Oxalate
Pyro
Reservoir Water
Residues (Oil Still)
River Water
Salt Water
Sauces (table)
Sewage (general)
Sherry
Soda Developer
Sodium Bicarbonate
Sodium Hypochlorite
Sodium Phosphate
Sodium Salicylate
Soft Soap
Stearic Acid
Sugar Solution
Sulphur Gases (hot)
Sugar (raw)
Sulphur Gases (hot)
Tan Extract (Leach Liquor and Finished Extract)
Tannic Acid
Tartaric Acid
Tomatoes
Uric Acid
Urine
Vinegar (Malt)
Whiskey

This illustration shows a small part of the "Cimet" equipment installed in a large powder company. Here "Cimet" is reducing costs because it successfully resists the nitric acid with which it comes in contact.

You, too, can enjoy this economy factor by specifying "Cimet" for those parts which must resist corrosion.

No *"Cimet"* part has yet failed.

Everything is Cimet but the Tanks

TRADE MARK

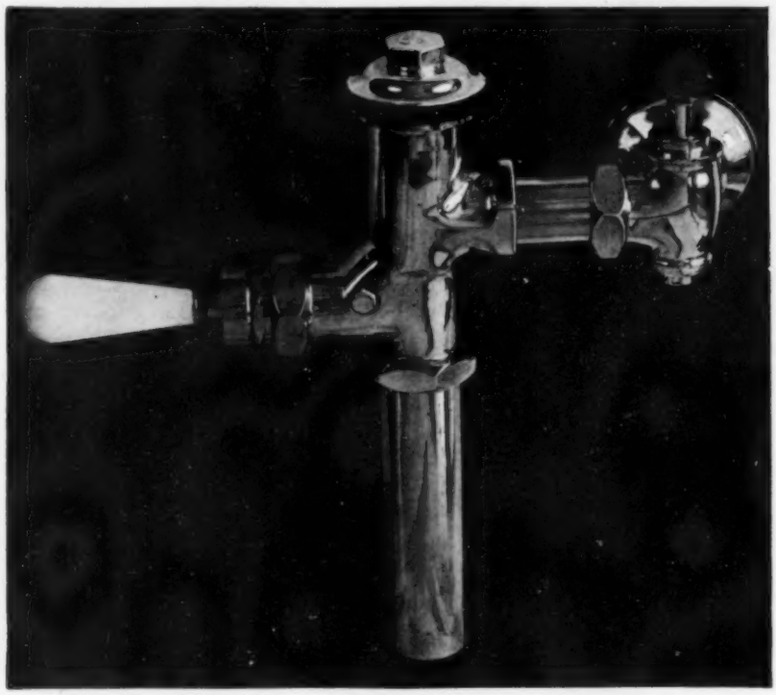
Write for our "Cimet" Folder

DRIVER-HARRIS COMPANY
HARRISON, NEW JERSEY

Chicago Detroit Morristown, N. J. England France

for
Example:

Crodon-plated Leo Flush Valves have been submitted to salt-spray tests of more than 300 hours without developing any signs of rust spots.



Flush Valves that *Never* Tarnish

AMONG those manufacturers who have adopted CRODON as a finish for metal products is the Leo Flush Valve Company. Their valves are now obtainable from stock either in nickel-plate or in CRODON.

Although the CRODON-plated valves fetch a premium, they are being specified in an increasing number of cases. For CRODON is proof against tarnish or atmospheric corrosion and architects know that it will retain its lustre indefinitely without any polishing cost.

Manufacturers seeking to improve products with exposed metal surfaces or to secure longer service from mechanical equipment should obtain full details about CRODON from the Chemical Treatment Co., Inc., 26 Broadway, New York City

CRODON *Resists:*

Atmospheric corrosion. Organic and most mineral acids. Sulphur and sulphides. Abrasion, because it is one of the hardest of metals. Oxidation to 1350° F. Physical breakdown to 2500° F. Tarnishing of its brilliant surface.

CRODON

The Chrome C T *Alloy Plate*

Applied Only to Quality Products

Commercial

Tungsten—Molybdenum—Tantalum

The Fansteel Products Company has for years been engaged in the study, development and production of rare metals. At the present time it produces commercially three metals belonging to a peculiar group: Tungsten, Molybdenum, and Tantalum. It has prepared data on their properties and some of their uses, and in some cases has developed these uses commercially. The most common uses are stated below.

TUNGSTEN. The main use at present made of this metal is in contact points, of which this company produces 20 million in various sizes yearly.

MOLYBDENUM. This is used as both structural and electrode elements in electronic tubes. One of its most important uses is as the winding in the construction of high-temperature resistor furnaces.

TANTALUM. This too is used as structural and electrode elements in electron vacuum tubes, as well as for filament and as a "getter" for freeing vacuum tubes from gas. When cold it is impervious to all acids but hydrofluoric, and for this reason is usable for laboratory dishes, spatulas, spoons, electrodes for electroanalysis.

The most important use of this metal so far developed is as an electrolytic valve. In common with some other metals it has the quality of allowing current to pass through in only one direction when immersed in acid. Most metals however are subject to corrosion from acid. Tantalum is not. Consequently it makes an ideal metal for rectifiers, making possible a rectifier of the simplest construction and indefinitely long life.

It is now used, under the trade name of Balkite, in 500,000 Fansteel rectifying units, both in radio and in industrial work. Its industrial applications are especially interesting, since it makes possible the installation of a battery and rectifier as a permanent complete unit furnishing D. C. current from an A. C. source.

Circulars containing the information thus far secured on these metals have been prepared, and will be sent on request.

FANSTEEL PRODUCTS COMPANY, Inc.

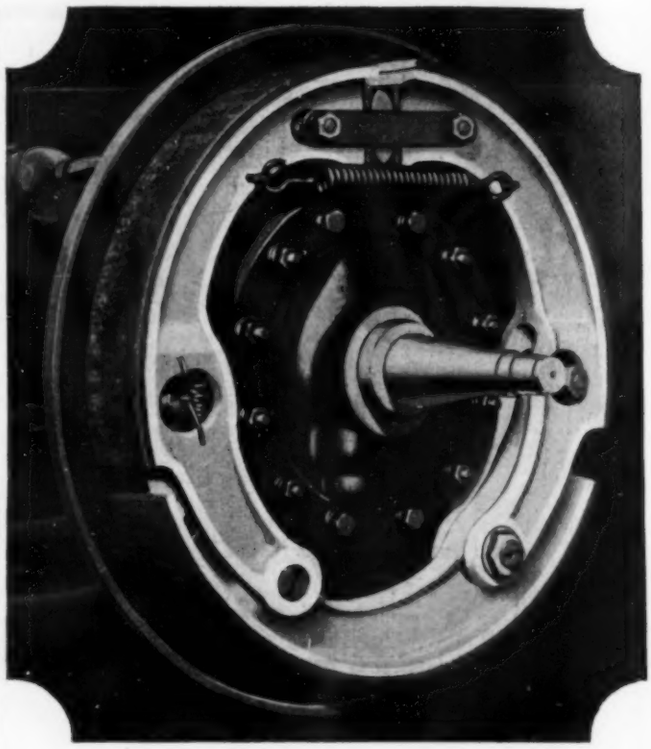
Office, Plant and Laboratory

NORTH CHICAGO, ILLINOIS

THE plant superintendent and the chemical engineer know the fitness of COPPER and its alloys for use in the chemical field.

When adaptable, these metals give durability and the greatest freedom from corrosion; ease of casting, forging, stamping and machining, and highest efficiency under thermal conditions.

COPPER & BRASS
RESEARCH ASSOCIATION
25 Broadway – New York



Bendix and Udylite

Bendix brakes are world leaders, known and appreciated by thousands of drivers of better cars throughout the country. They must function perfectly in all weathers, under the most trying conditions, in season and out.

They must be rust proof.

The working mechanism of Bendix brakes is protected from rust by Udylite, the one process that was found, after many rigorous tests, to be perfectly adapted for this hard job.

The Udylite process for electroplating with cadmium results in a beautiful soft gray finish that will not scale, chip, peel, crack or blister, that forms an actual amalgamation with the surface of the metal itself. For a prompt and full reply write

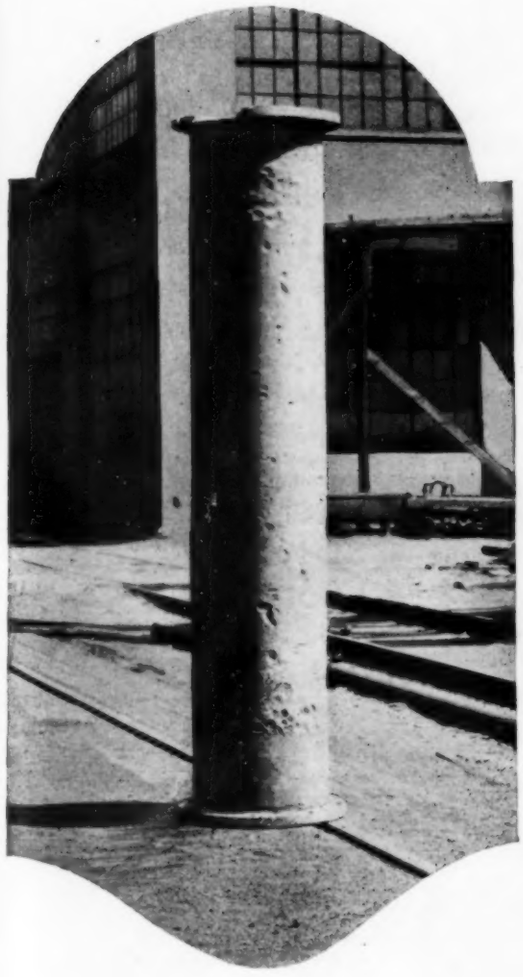
THE UDYLITE PROCESS COMPANY
KOKOMO, INDIANA

[Cadmium Salts, tested and fully guaranteed, are supplied by the Udylite Process Company at prevailing market prices.]

Udylite
RUST PROOFS

Hybnickel

Heat Resisting Alloys *will NOT absorb Sulphur*



You know the old theory regarding the excessive sulphur-absorption by heat-resisting castings containing nickel, operating in contact with compounds containing sulphur.

Hybnickel Alloys have proved that theory entirely erroneous

Hybnickel Alloys, containing a sufficient amount of nickel for strength and heat-resistance, do NOT absorb sulphur.

The Hybnickel Retort shown here was in continuous use over 3 years, calcining a high sulphur compound (Lithopone). The fuel used contained about 1% sulphur.

This Hybnickel Retort was scrapped only because of a broken flange. Study the unretouched photograph. See the minute amount of pitting.

When this retort was broken up there was found *no grain growth whatsoever,* and no sulphur whatever in excess of that contained in the original metal.

Other makes of retorts free from nickel were tried by the same manufacturer, and lasted only 3 months to 1 year, with patches and repairs during that period. As the Chinese say, "One demonstration is worth a thousand arguments."

We have applied for patent protection on the use of Hybnickel Alloys for sulphur resisting purposes.

Manufactured by Pusey & Jones, Wilmington, Delaware

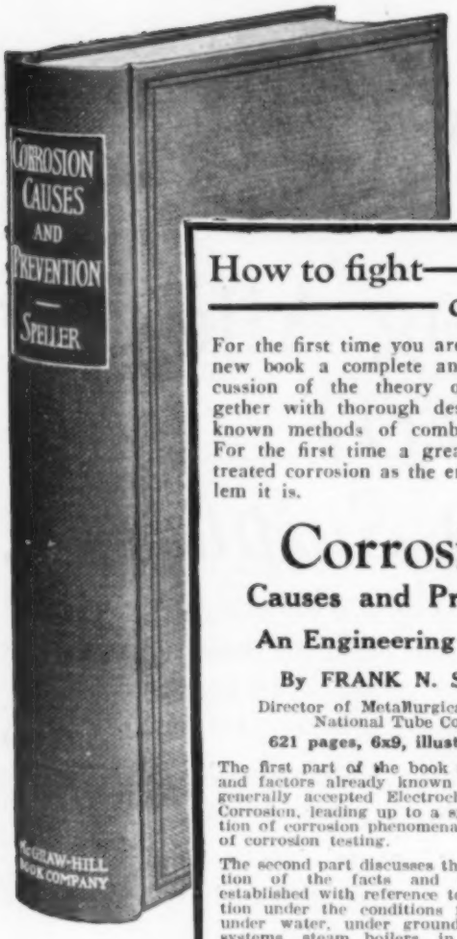
Address all inquiries to

VICTOR HYBINETTE

Care of The Pusey & Jones Co., Front and Poplar Streets

Wilmington, Delaware

The New York Office,* 300 Madison Ave., *has been discontinued



Just Out!

How to fight——— corrosion

For the first time you are offered in this new book a complete and practical discussion of the theory of corrosion together with thorough descriptions of all known methods of combating corrosion. For the first time a great specialist has treated corrosion as the engineering problem it is.

Corrosion

Causes and Prevention

An Engineering Problem

By FRANK N. SPELLER

Director of Metallurgical Department
National Tube Company.

621 pages, 6x9, illustrated, $6.00

The first part of the book describes the facts and factors already known together with the generally accepted Electrochemical Theory of Corrosion, leading up to a system of classification of corrosion phenomena and the principles of corrosion testing.

The second part discusses the practical application of the facts and principles already established with reference to corrosion prevention under the conditions formed in the air, under water, under ground, in closed water systems, steam boilers, in the chemical industries and in other situations.

A few of the facts discussed

—summaries of the investigations of every important research in the field of corrosion;
—real facts on the effect of composition on the durability of iron and steel;
—descriptions of the corroding action of agencies from 40 media external to the metal itself;
—outline of accurate methods of corrosion testing;
—thorough discussions of corrosion causes and cures in practically all important fields;
—relative corrodibility of the various types of iron and steel.

Mail the coupon for your copy

Dr. Speller's book is one of the most important engineering books of the year. The coupon brings your copy for 10 days' free examination.

Just Out!

A book to help you cut down wastage due to corrosion

See it free

McGRAW-HILL
FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York.

You may send me on 10 days' approval—**Speller—Corrosion: Causes and Prevention, $6.00 net, postpaid.** I agree to pay for the book or return it postpaid within 10 days of receipt.

Subscriber to Chem. & &Met. Eng.?.....

Signed .....
(Please print)

Address .....

Official Position .....

Name of Company .....

(Books sent on approval to retail purchasers in U. S. and Canada only.) M. 6-1-26

THERMIT

Carbide Free Metals and Alloys

Ferro Titanium.....25% Ti.
Ferro Chromium.....60% Cr.
Ferro Tungsten.....75-80% W.
Ferro Vanadium.....35-40% V.
Pure Manganese....96-98% Mn.
Pure Chromium.....97-98% Cr.

Send for Pamphlet No. 2041

METAL & THERMIT CORPORATION
120 BROADWAY, NEW YORK CITY

Pittsburgh Chicago Toronto Boston S. San Francisco

The Allegheny Steel Company

Brackenridge, Pa.

GUARANTEES

Corrosion Resisting

ASCOLOY

(Stainless Iron)

Corrugated and Flat Roofing
and Siding Sheets

against normal corrosion conditions

ASCOLOY Roofing and Siding

is particularly adapted to combat the corrosion encountered in Chemical, Metallurgical and Allied Industries where ordinary roofing and siding must be frequently replaced.

Ask us for the latest revision
of our Technical Bulletin

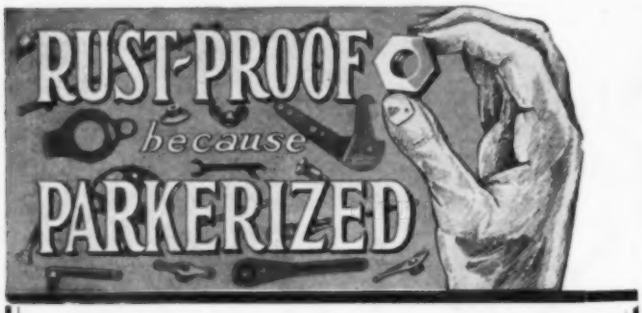
See our exhibit at

Machinery Hall, Sesqui-Centennial,
Philadelphia, Pa.

THE ALLEGHENY STEEL COMPANY
Brackenridge, Pa.

District Offices: New York Detroit Chicago

ASCOLOY is carried in warehouse stock by
JOS. T. RYERSON SON, INC., Chicago, Illinois.



HAVE you ever tried to turn a rusty nut which simply would not move, experienced trouble with a spring so corroded that it could not function, or with a hinge so far gone that it would not operate?

Do you know that iron unprotected immediately begins to return to its original state—rust? Rust destroys iron and steel. It is insidious in its attack—cancer-like it spreads under the surface. It destroys viciously—eats through nickel plating, enamel or paint quickly.

Rust can be prevented. Rust-proofing by Parkerizing with PARCO POWDER is effective, economical and practical for large or small production.

PARCO POWDER is a revolutionary advance in rust-proofing by Parkerizing. It has many advantages over every other known method. It brings the Parker Process within the means of every manufacturer working in iron and steel.

Parkerizing creates a perfect base for enamel or paint. It assures the arrival of exports in good condition. It protects goods on the dealer's shelves or in use. In efficiency and economy, Parkerizing stands alone as the method of rust-proofing iron and steel.

Why not have a demonstration upon your product without cost or obligation to you? To be able to say "rust-proof because Parkerized," is a powerful selling force.

Our publication *"The Parkerizer"* will be mailed to any manufacturer or industrial executive upon request—likewise our book *"Parker Rust-Proofing Process,"* which treats the rust-proof problem fully, is yours for the asking.

PARKER RUST-PROOF CO.
2178 Milwaukee Ave., East
DETROIT, U. S. A.

CORROSIRON
MADE IN U.S.A.
ACID RESISTING

Puts long life into your

Castings Pipe
Fittings Valves

We are corrosion specialists—let us discuss your problem with you.

Catalog on request.

Pacific Foundry Company
Harrison and Eighteenth Streets
San Francisco, Calif.

APPLIES, either in the shop or in the field, a coherent attached or separable coating of any of the commercial metals on any substance.

Costs little to buy, operate and maintain.

CHROMIUM PRODUCTS · TRADE MARK · CR PLATE · CORPORATION ·

A new Surfacing for your equipment

CHROMIUM PLATING

greatly increases the life and usefulness of a wide range of fabrications—including equipment employed by Process Plants, and certain products.

This process of electroplating with pure Chromium is conducted in our factory, or in the plant of any manufacturer licensed by us to use the process. It adds little to the cost of production—in fact, when it makes possible such economies as the use of soft steel instead of high-carbon steel and case-hardening, or of similar savings in material costs, the manufacturing expense often is actually lowered.

Chromium Plating gives a protective covering to steel, copper, brass and other metals—providing a surface that is exceedingly hard and resistant to abrasion and wear; resistant to atmospheric corrosion, acids and alkalies; permanently attractive with either a brilliant or a satiny-gloss finish. Replating is possible. Worn parts of tools or equipment can be built up, repeatedly.

Investigate this profitable, service-increasing process.

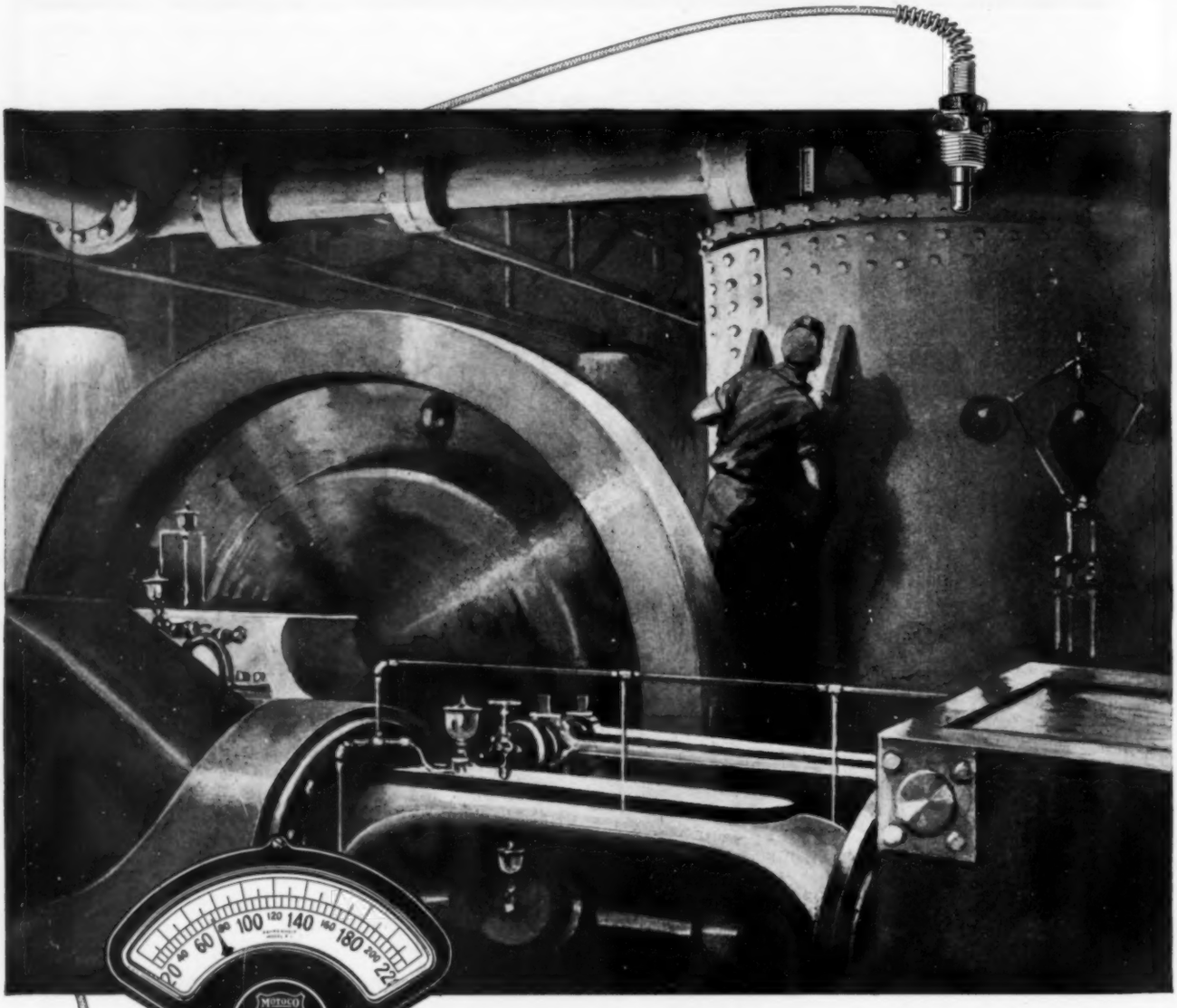
It Gives

1. Diamond-like hardness.
2. Platinum-like finish.
3. Rust-proofing.
4. Resistance to acids and alkalies.
5. Lasting protection.
6. Economy.

A Thousand-and-One Applications

Chemical Containers
Valves
Evaporating Dishes
Pyrometer Tubes
Stirrers
Cylinders
Piston Rods
Rolls, Etc.

CHROMIUM PRODUCTS CORPORATION
120 BROADWAY, NEW YORK
WORKS:
92 Bishop Street
Jersey City, N. J.
U. S. A.



Motoco Industrial Thermometer Distance Type

What MOTOCO will bridge

Back of a spinning fly-wheel, atop a shaky ladder, a man must crawl many times a day to read a thermometer. Each time he carries his life in his hands.

Frequent and accurate readings are necessary for close control of the temperature and efficient plant operation. But readings will be neglected until they are made safe. They can never be accurate until they are made easy.

The Motoco Distance Type Industrial Thermometer bridges danger. At the point where the temperature must be known is a simple, unbreakable metal bulb. At another point, several feet away, where readings may be taken safely and conveniently, is a clear dial with bold black figures and a bright red hand. Between the two is a flexible cable that is not affected by the temperature of the surrounding atmosphere.

The Motoco costs no more than a good glass-tube thermometer. Send for free catalog No. 3.

DANGER

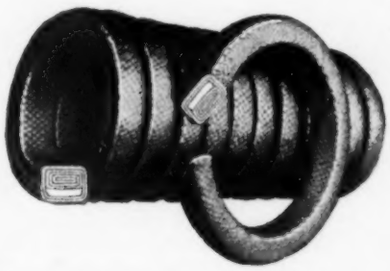
Boyce Moto Meter

The Moto Meter Company, Inc.
Industrial Thermometer Division
3 Wilbur Avenue, Long Island City, N. Y.

These four "U. S." Packings are built for the chemical industry

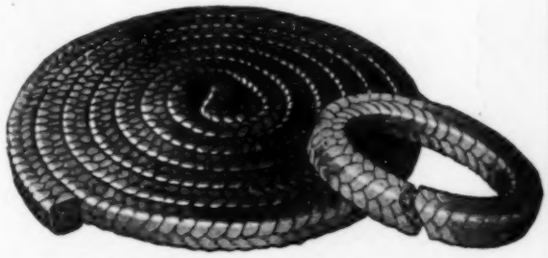
"U. S." Vanda Superheat Sheet Packing

For packing flanges or joints against superheated or saturated steam, air, acids, oils, ammonia or alkaline conditions. Recommended for practically any condition where a sheet packing can be used. It will resist the highest pressure or temperature.



"U. S." Rainbestos High Pressure Packing

Recommended for packing rods against high pressure steam and air. Especially adapted for general service in chemical plants on rods and valve stems of all types of engines, steam turbines and pumps.



"U. S." Centrifugal Pump Packing

Recommended for use on Centrifugal Pumps. This Packing will not harden up in use and can be installed for any pressure, with hot or cold water and brines.

No. 1616 Rubber Stock

Recommended for use in pumps handling sulphuric acid and caustics.

"U. S." Packings do make a difference—

There's a "U. S." Packing specially built for every chemical engineering need.

Every time a packing goes wrong, it means a shut-down for repacking and a resultant drop in output somewhere along the line.

There is a difference in packings. No one packing is a cure-all for all your packing needs. Packings today are selected for the specific purposes they are to perform. Probably no industry has a greater need for efficient, effective, specialized packing service than in the chemical industry and allied fields.

"U. S." Packings are the result of thorough investigations and study of chemical plant conditions. This actual experience, combined with long years of manufacturing packings for every industrial packing requirement, has resulted in a complete line of "U. S." Packings.

Chemical engineering plants throughout the country are learning the value of standardizing on "U. S." Packing—made by the world's largest grower, manufacturer and distributor of rubber and its products—The United States Rubber Company.

Let our sales engineers, who are experts on packings, advise you as to the most suitable type or combination to meet the individual packing requirements of your plant.

United States Rubber Company

1790 Broadway (US Trade Mark) New York City

Branches in every industrial center

"U.S." PACKINGS

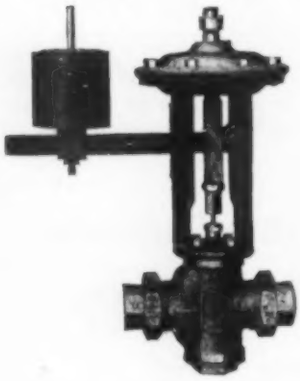
for every chemical engineering need

"I let Mason take the responsibility for pressure control"

I have too much on my mind to worry about inaccurate pressure control. That's why I depend upon Mason Regulators to take that burden off my shoulders.

For the lasting accuracy and reliability that mean genuine economy, Mason Regulators are unsurpassed. No matter what the service required, there's a *Mason* designed expressly for that service.

May we send you our Catalog 62?



Mason No. 30
Steam Vacuum Pump
Regulator

9153

Mason Regulators
MASON REGULATOR CO.
Boston, Mass.

San Francisco Office, 606 Howard Street
Mason Regulator Co. of Canada, Ltd., 314 Notre Dame St. West, Montreal

Introducing a New GARLOCK QUALITY CONTROLLED PRODUCT

GARLOCK—377

Garlock 377 is a lubricated non-friction metal packing with side walls, back and cushion of frictioned asbestos cloth

The metal core is manufactured from a solid piece of non-friction metal. The Special Garlock Design procures a number of small metal surfaces so staggered as to give a pressure tight bearing on the rod. The cuts in the metal impart extreme flexibility to the packing enabling it to closely encircle the rod.

Small round concealed punchings act as emission holes for the lubricant that is retained in the many folds of the metal.

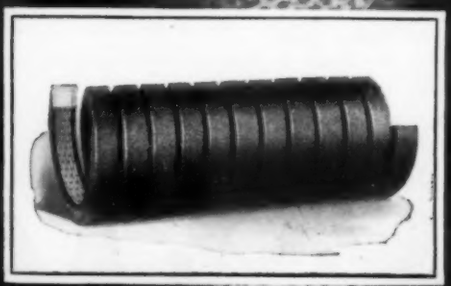
The asbestos side walls and back hold the metal in place and the folded asbestos core above the metal acts as a pusher and compensating cushion to bring the metal to the rod at an even pressure.

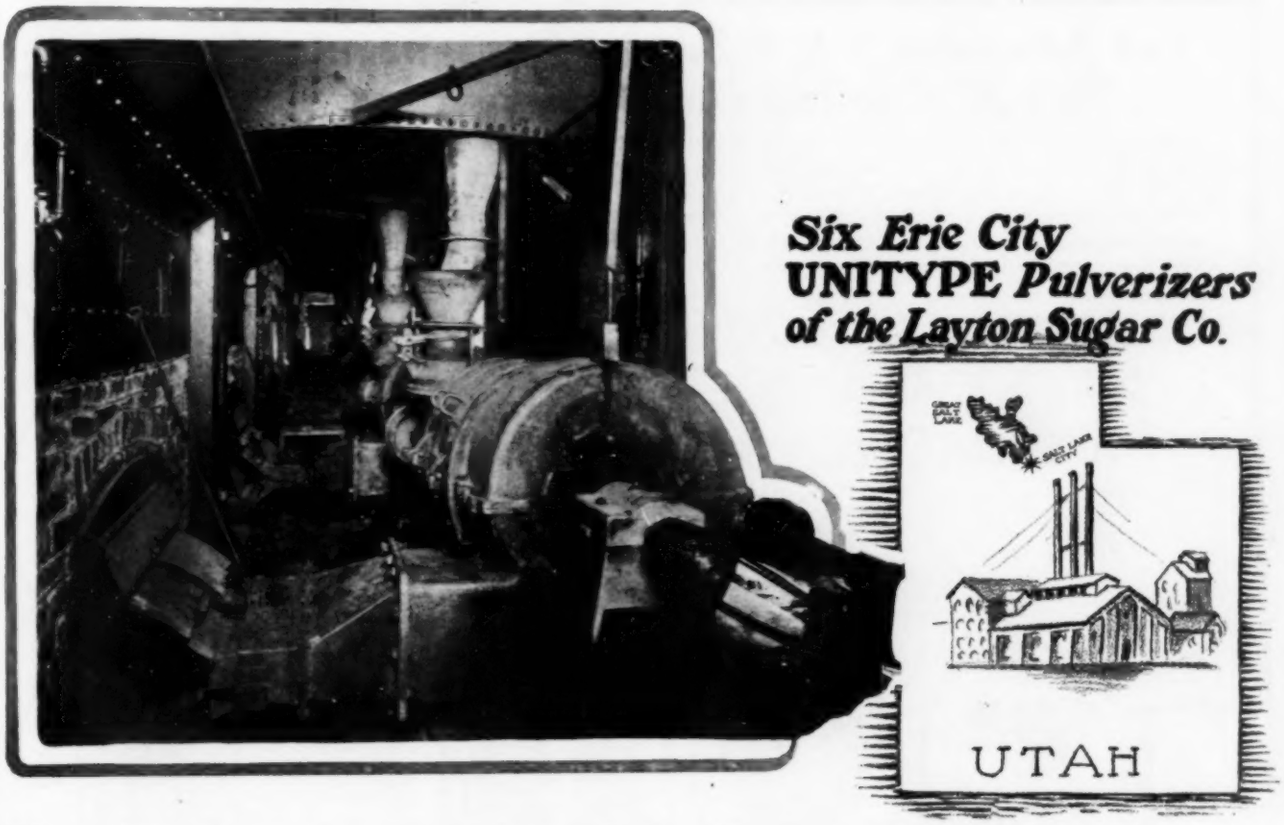
The ratio of wear on the bearing surface of the packing is the same at all times on account of the square construction of the metal core.

Garlock 377 is particularly recommended for service on the piston rods of main engines on steamships, deck engines, hoisting engines, steam shovels and dredges, steam hammers, kickers and steam niggers in the lumber trade and a general all around steam engine packing

THE GARLOCK PACKING CO.
Manufacturers of Mechanical Packings
PALMYRA, N. Y., U. S. A.

Sales Offices and Warehouses in all Principal Industrial Centers





Six Erie City UNITYPE Pulverizers of the Layton Sugar Co.

Showing how one member of the Process Industries has successfully handled the "steam problem"

The Layton Sugar Company at Layton, Utah, uses six 2000 lbs. capacity UNITYPE pulverizers, and they handle all grades of bituminous.

Also, these pulverizers are driven by an Erie City Lentz engine through a shaft and silent chain drive. The exhaust steam from the Lentz engine is used for heating and other process work.

This makes an ideal combination for any plant in the Process Industries.

Our engineers will gladly go into further details regarding the operation of our products in the industrial plant. Drop them a line.

ERIE CITY

ERIE CITY IRON WORKS
EST. 1840
ERIE, PA., U.S.A.

MODERN STEAM POWER PLANTS

UNITYPE Powdered Fuel Equipment—Water Cooled Furnaces—Coal Handling Equipment—Boilers: Inclined, Vertical and Horizontal Water Tube—Boilers: Economic, Horizontal and Vertical Fire Tube—Engines: Lentz Poppet Valve, High Speed, Variable Speed—Pressure Vessels—Tanks—Grey Iron Castings.

Let American S & B Service Department Help You to Increase Your Profits

For more than 75 years we have specialized in the manufacture of instruments for the promotion of efficiency in power plants and manufacturing departments. During this time we have assisted hundreds of manufacturers to lower manufacturing costs, eliminate spoilage and increase efficiency. What we have learned in our vast experience we can apply to your business.

Each member of our Service Department is a highly trained and widely experienced engineer. Each has proved his ability to assist manufacturers by the use of American S & B Instruments.

An hour or two spent with one of our engineers might give you ideas that would save you real money. In any event, it will reveal to you the most efficient methods known to modern manufacturing so far as the use of efficiency instruments is concerned.

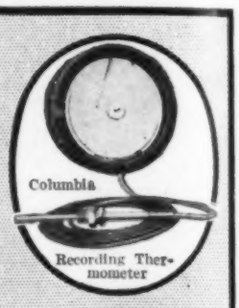
Will you permit one of our engineers to study your business and submit the result of his findings? It will involve no obligation on your part. Write for Catalog N-4.

AMERICAN SCHAEFFER & BUDENBERG CORP.

BROOKLYN, N. Y.

Atlanta, *Boston, Buffalo, *Chicago, Cleveland, Detroit, *Los Angeles, Philadelphia, *Pittsburgh, Salt Lake City, *Seattle, St. Louis, Tulsa
*Stocks carried at these branches

Direct Factory Representatives for Eastern Canada:
Mechanical Equipment Co., 807 New Birks Building, Montreal
For Middle Western Canada: Kipp-Kelly, Ltd., 68 Higgins Ave., Winnipeg


Columbia Recording Thermometer

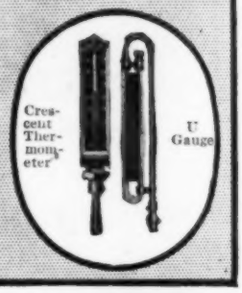
Columbia Recording Gauge

Honeco Temperature Controller

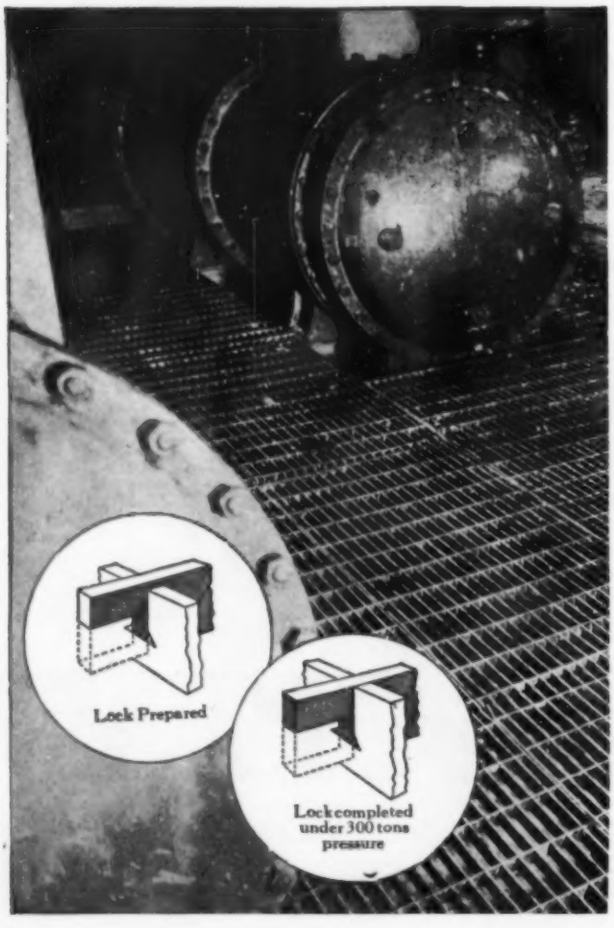
American S & B Pressure Gauge

American Water Relief and Pop-Safety Valves

Reform Dial Thermometer


Crescent Thermometer

U Gauge



MITCO Registered

Interlocked Steel Grating

This type of flooring stands the strains and stresses of heavy loads. It is cool and comfortable. Light and air can penetrate to spaces beneath the floor. "*Mitco*" provides safety of foot for workmen, under any conditions. It is non-clogging and non-slipping. It offers excellent traction for wheeling and trucking. Oil, grease or water do not make it slippery. Write for details.

Illustration shows Mitco Grating around the Feed Water Heaters in the Super-Power Station of the Ohio River Edison Company, Toronto, Ohio. Designed and constructed by Stevens & Wood, Inc., New York City.

Hendrick Manufacturing Company

"Makers of Hendrick Perforated Metal Screens"
61 Dundaff St., Carbondale, Pa.
New York Office: 15 John St. Phone Cortland 2440
904 Union Trust Bldg., Pittsburgh, Pa.

Recording Gravity with Greater Accuracy

BAILEY GRAVITY RECORDER
TYPE S5
With Pump for Circulating Sample Drawn from Tanks, etc.

The true specific gravity of any liquid or solution is continuously and accurately recorded on 24-hour charts by Bailey Gravity Recorders which compensate automatically for all changes in temperature.

Accuracy within 1% of the chart range is guaranteed. The charts form a permanent record, as they are removed daily, dated and filed away for future reference.

The records are made with the liquid flowing through a pipe line or from samples of the liquid that are continuously withdrawn and returned to tanks.

Should you visit a few plants in which Bailey Gravity Recorders are installed and ask the operating engineers what they think of them—the opinions expressed would do more to convince you of the desirability of their use than anything we could say about them.

Details are given in Bulletin 191.

Let Bailey products furnish you the *basis for more accurate plant accounting*—Bailey Fluid Meters, Boiler Meters, Water Meters, V-Notch Meters, Meters for Granular Materials, Air Meters, Gas Meters, Tachometers, Multi-Pointer Gages, Gravity Recorders and Differential Recorders to meet every requirement in industrial and power plants.

BAILEY METER COMPANY

(A Babcock & Wilcox Organization)

2025 East 46th Street, CLEVELAND, OHIO

BAILEY METERS

A Jenkins disc is easily and quickly renewed without removing the valve from the line.

Jenkins Renewable Disc

Interchangeable!

It takes an engineer a minute or so to lengthen the life of a veteran Jenkins Valve and to make unnecessary—for a long time—the purchase of a new one. It may be a new disc that is needed. It may be a new spindle or a new bonnet. All parts of Jenkins Valves fit perfectly into other Jenkins Valves of the same type and size.

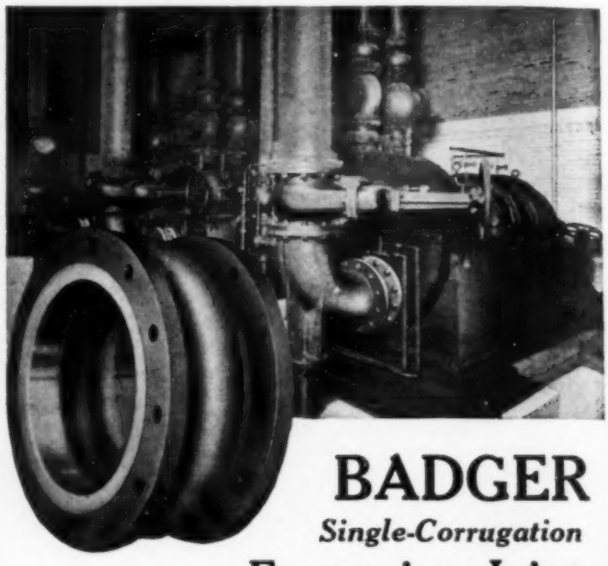
Are you taking advantage of this interchangeable feature—getting your share of the maintenance economies it effects? The Jenkins "Diamond" mark on the body of a valve is of itself an assurance of long, uninterrupted service. And the fact that Jenkins manufacture is thoroughly standardized makes interchangeability a certainty. Genuine Jenkins Valves and parts are obtainable through supply houses everywhere.

JENKINS BROS.

80 White Street.....New York, N. Y.
524 Atlantic Avenue.....Boston, Mass.
133 No. Seventh Street.....Philadelphia, Pa.
646 Washington Boulevard.....Chicago, Ill.

JENKINS BROS., LIMITED
Montreal, Canada London, England

Always marked with the "Diamond"
Jenkins Valves
SINCE 1864



BADGER
Single-Corrugation
Expansion Joints
—for low pressure and vibration

Selection of an adequate protective joint between turbine and condenser should not be left to guesswork. It's an engineering job—the safety of costly equipment is at stake.

Badger Single-Corrugation Expansion Joints effectively take care of vibration and vacuum and are life-time protection to equipment and pipe lines.

Of one-piece, packless design Badger Expansion Joints *never* require attention. Copper formed in such a way as to insure uniform thickness and strength throughout insures safety and care-free operation, and they are installed as easily as any flanged fitting.

Badger Expansion Joints are known by their service records.

Write for details of sizes and types.

Badger Engineering Service

Your problem offers an opportunity for Badger Service as designing engineers, manufacturers and installation experts of:

Spray Cooling Ponds; Cooling Towers; Pipe Bends; Air Washers; Dust Washers; Special Apparatus for Cleaning Flue Gases; Chemical Apparatus; Copper and Sheet Metal Work.

Since 1841

E. B. BADGER & SONS CO.

75 Pitts St., Boston, Mass.

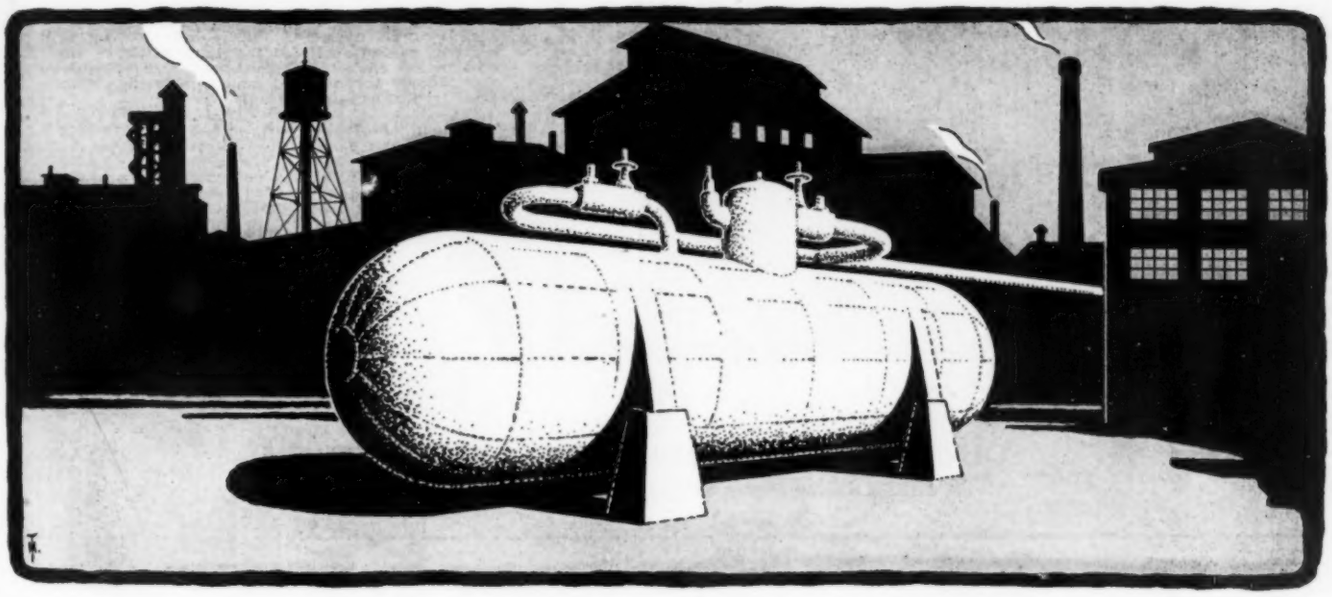
New York: 101 Park Ave. **Toledo: Ohio Bldg.**
Tulsa, Okla.: Mid-Continent Bldg.

Representatives in all principal cities

TRADE MARK

and now

Steam Storage



The Ruths Accumulator enables boiler plants to meet fluctuating steam loads while operating at a constant and economical rating.

Steam stored when demand is sub-normal is instantly available at uniform pressures in any desired quantity to meet peak loads.

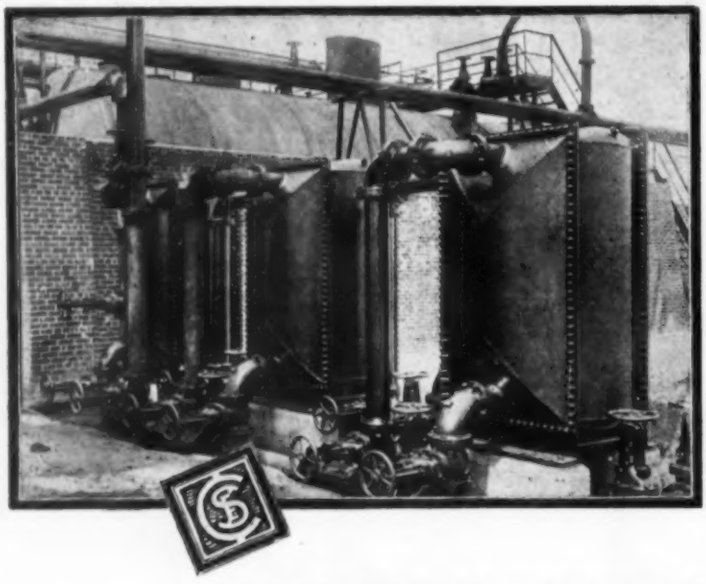
By equalizing fluctuations between demands for steam and demands for power the Accumulator greatly increases the output of cheap non-condensing power from a given amount of process steam.

Ruths Regulating Valves automatically control the operation of the Accumulator, maintaining uniform pressures and temperatures throughout the plant.

Ruths Accumulator Company Inc.
292 Madison Avenue *New York City*

"SOUTHWESTERN"

CONDENSERS and HEAT EXCHANGERS



Design and Construction Evince Superiority

In design and construction, throughout every component part, of "Southwestern" Condensers and Heat Exchangers, superior engineering skill is very evident. It is this that achieves their maximum efficiency, economy, and complete, satisfactory service, and has set new high standards of performance.

The demand of chemical, metallurgical and refinery industries for high pressure, and high temperature apparatus, of high standards of excellence, to operate with perfect safety and positive results under severe conditions, has not only been admirably and fully met but objectionable features of other equipment have been eliminated.

The service of "Southwestern" engineers in solving problems, is at your disposal. You can depend on Southwestern.

Catalog R on request

Absorption Plants
Complete Refineries
Power Plants
Condensers
Heat Exchangers
Refinery Apparatus

SOUTHWESTERN ENGINEERING CORPORATION
1221 Hollingsworth Bldg., Los Angeles, California

Where Oils, Greases, and Liquids are handled, use

IRVING PATENTED SUBWAY FLOORING

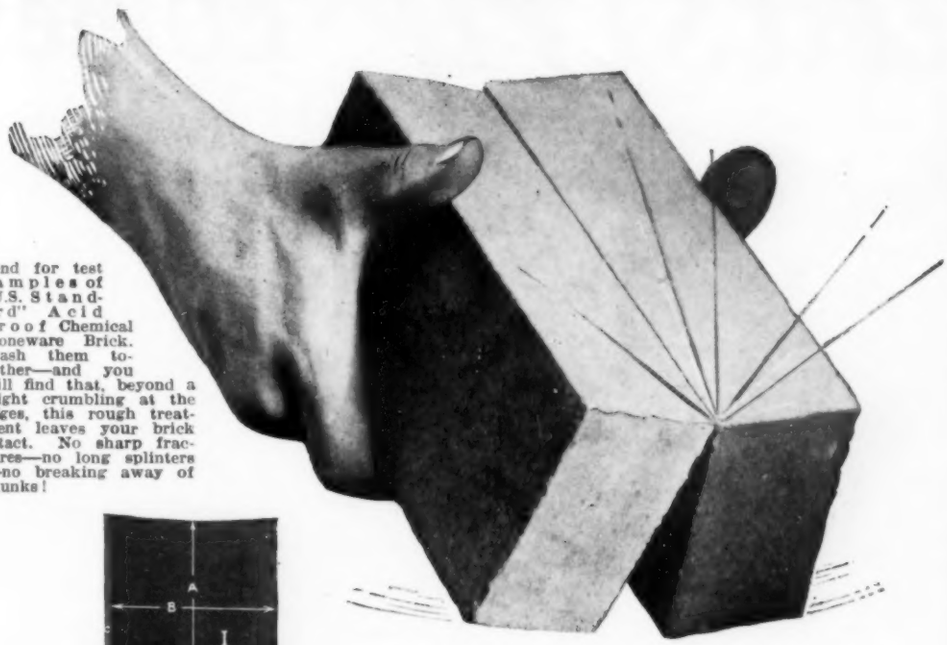
No pools or puddles on a **"Subway"** floor, for men to flounder around in, and slip or fall. Nothing can make **"Subway"** slippery. And where there's heat, or fumes, or gases, the ventilating value of an open **"Subway"** floor quickly reveals itself. The cost? Less than you imagine, and the lowest per year of service.

You should have Catalog 4A-1

IRVING IRON WORKS CO.
LONG ISLAND CITY, N.Y. U.S.A.

P-92

MAKE US PROVE IT



Send for test samples of "U.S. Standard" Acid Proof Chemical Stoneware Brick. Crash them together—and you will find that, beyond a slight crumbling at the edges, this rough treatment leaves your brick intact. No sharp fractures—no long splinters—no breaking away of chunks!

U. S. Stoneware excels in tests for

- Uniformity of quality.
- Crushing Strength.
- Tensile strength.
- Resistance to impact.
- Sudden temperature changes.
- Extreme heat.
- Extra Acid-Proofing factor.
- Smoothness of surface.
- Application of *liquid* glaze where most needed.

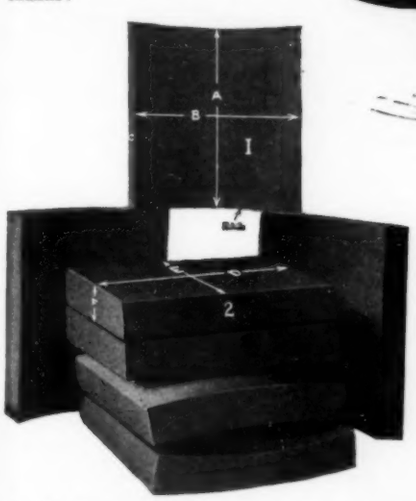


FIG. 95—Radial or Straight Acid-Proof Lining Tile

	A	B	C	D	E	F	Radius
Size No. LT....	8	4	1 3/4	8	4	1 3/4	ANY
Size No. JS.....	8	6	2	8	6	2	ANY
Size No. 1.....	8	8	1 3/4	8	8	1	ANY
Size No. 2.....	12	12	2	12	12	2	ANY

(All dimensions in inches)

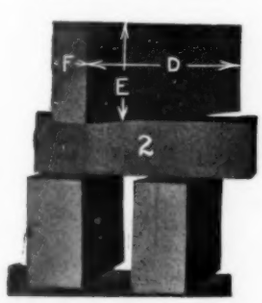


FIG. 11—Acid-Proof Brick

	D	E	F
Size No. 1.....	8	4	2
Size No. 2.....	8	6	2
Size No. 3.....	9	4 1/4	2 3/4
Size No. 4.....	12	4	2

(All dimensions in inches)

Acid-Proof Brick and Tile
for
Linings, Tanks, Vats, Agitators,
Acid Tower Construction,
Flooring, etc., etc.

CARLOAD LOTS of this superior "U. S. Standard" Acid-Proof Chemical Stoneware Brick and Tile are shipped to Industrial Leaders such as E. I. DuPont de Nemours & Co., the Standard Oil Co., Atlas Powder Co. and many others.

"U. S. Standard" Brick and Tile are specified on superior strength, ease of cementing, standardization of quality and uniformity, and *thorough* vitrification.

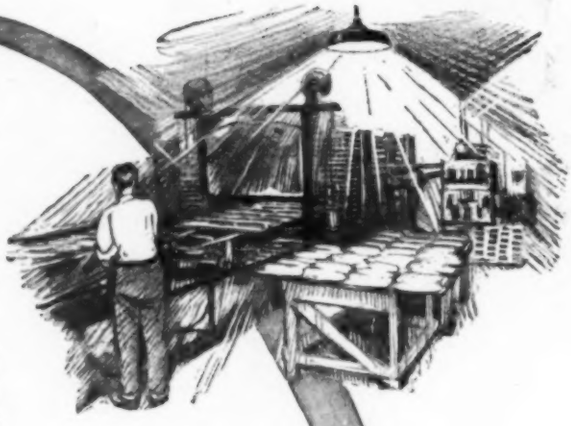
STRENGTH is demonstrated by any reasonable crushing, tensile or impact test, and—in actual field use—by length of service under varied conditions of stress and temperature. CEMENTING is made easy by our exclusive process of *Liquid* glazing—whereby one side of the brick or tile presents a smooth, glossy surface while the other surfaces are left rough and unfinished, to give a firmer holding of cement and more secure caulking. STANDARDIZATION is made possible by our ownership of the clay mines which supply the high-grade, uniform raw materials. "Double" VITRIFICATION is provided by the *thorough* and complete acid-proofing of the unglazed product and the extra acid-resistance given by the liquid glazing—burned into the body of the brick or tile. (Also note the standardized dimensions and sizes—simplifying ordering.)

For all these desirable "U. S. Standard" qualities you pay no more than for inferior, weaker products. Write for samples and price quotations.

THE U. S. STONEWARE CO.
Works (Since 1865) AKRON, OHIO, U. S. A.
New York Office: 50 Church Street

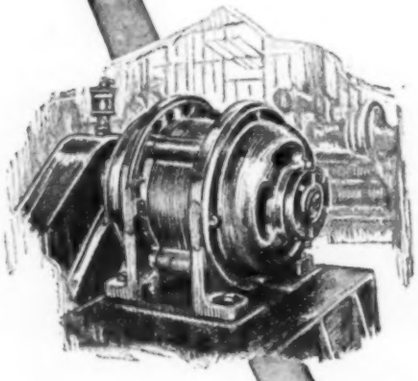
U.S.STONEWARE

Industry comes



For its Light

Electric lighting so excelled all other forms of illumination that fears of excess cost were swept aside in the universal desire for its great advantages. Following its acceptance came improvements to industry that made it the most economical form of illumination known.



For its Power

Electric drive cleared industry of its expensive and dangerous jungle of shafts and belts, brought great flexibility of operation, and speeded manufacture to a high pitch. Such were the economies effected that the cost of the old drives scrapped and the new motors installed, never entered the picture.

ULTIMATELY
ELECTRIC HEAT
IN EVERY INDUSTRY

And for **Its Heat**

GENERAL

GENERAL ELECTRIC COMPANY, SCHENECTADY, NEW YORK

to Electricity

A complete treatise on the subject of electric heat. Copies can be secured by writing the Industrial Dept., General Electric Company, Schenectady, N. Y.

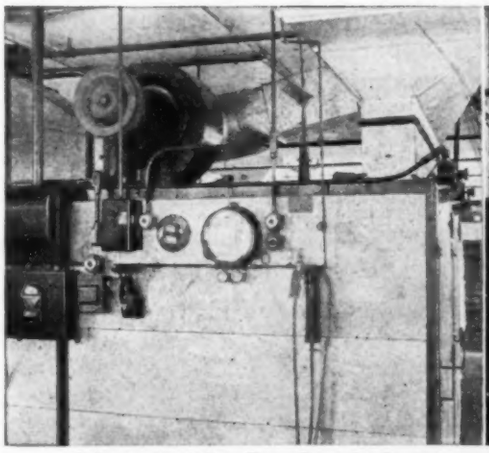
The Process Industries

Clean, safe, economical heat; generated in any quantity, or at any temperature desired; under perfect and automatic control; placed just where it is needed. That is electric heat!

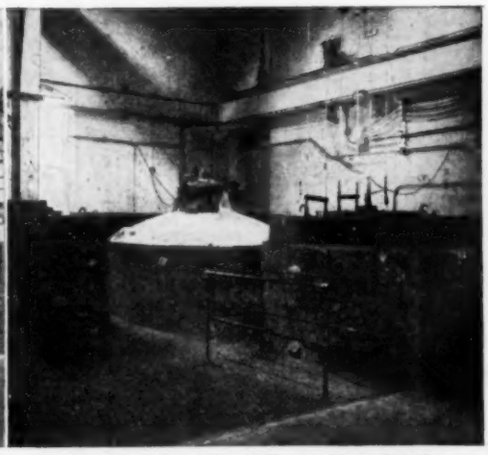
The Process Industries are using electric heat in an ever increasing number of applications:

Kettles, formerly heated with steam, now are heated by compact electric heating units.
Ovens—for drying effervescent salts and a host of compounds—now are heated with electric heat.
Impregnating Tanks, electrically heated, are operating more efficiently.
Electrically-heated Lehrs are annealing glass with such effectiveness that breakage has been practically eliminated and the quality of the glass has been greatly raised.
Vitreous Enameling Furnaces, equipped with electric heating units, are firing cleaner and better enamel with markedly decreased costs.
Baking Ovens, electrically heated, are producing bread and cake products that are a revelation in quality, cleanliness, and wholesomeness.
Countless processes are being hastened, improved, and more economically performed by the application of sheath wire and cartridge types electric heating units.

The Process Industries are rapidly coming to electric heat to improve their products, speed their production, and to achieve impressive savings in a new field.



G-E Equipped Box Type Oven for Drying Citrocarbonate Salts.



Vacuum Impregnating Tanks Heated with G-E Electric Units.

ELECTRIC

570-

SALES OFFICES IN ALL PRINCIPAL CITIES

The KEMP Automatic Gas System

Concentrates heat where needed

ALTHOUGH the fire usually is small and applied only to the spot or surface to be heated, it is possible with this complete pre-mixture of gas and air to project flames a distance of three feet or more.

Combustion is rapid and the heating of contiguous surfaces is avoided.

Unequalled adaptability is afforded by the Kemp System. With it you can produce an oxidizing, reducing or neutral furnace atmosphere. Gas can be burned in enclosures containing an atmosphere that will not ordinarily support combustion—as in destructive distillation. And so on.

Some of the Remarkable Features of this Automatic Gas-and-Air Pre-Mixer

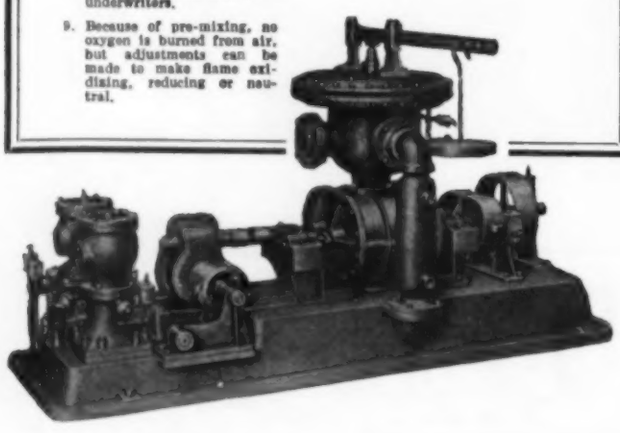
NOTE THESE ADVANTAGES

1. Exact mixture of air and gas required.
2. *Automatically* supplies complete gas-air mix to burners *as needed.*
3. Can be automatically controlled by thermostat.
4. No secondary air needed at burners.
5. Higher flame temperatures than with ordinary burner.
6. Flame cannot be smothered even when immersed in water. Burns in inclosed spaces; current of steam; gas containing no oxygen; etc.
7. Savings of from 30% to 50% in fuel gas.
8. Equipment approved by all insurance companies and underwriters.
9. Because of pre-mixing, no oxygen is burned from air, but adjustments can be made to make flame oxidizing, reducing or neutral.

Write for copy of the interesting Kemp Automatic Gas System Catalog, and learn the remarkably wide range of profitable application of this most scientific machine for burning a pre-mix of air and natural or artificial gas.

Note also that the KEMP has reduced gas consumption as much as 75% in certain Process plants!

The C. M. Kemp Manufacturing Co.
405-417 East Oliver St., Baltimore, Md.



DEMPSEY Industrial Furnaces

for *every* Industrial Heat Treating Use

DEMPSEY Copper Billet Heating Furnace at Baltimore Copper Smelting and Rolling Co. Plant

DEMPSEY Industrial Furnaces are reducing costs in every line of industry. They are soundly engineered and substantially built to insure continuous production with economy.

Furnaces for Annealing, Heat Treating, Welding, Melting, Galvanizing, etc.

A large stock of patterns enables us to make prompt deliveries of any size of furnace for any use.

We offer you the advantage of our 35 years' experience in furnace engineering. May we quote on that next furnace?

W. N. BEST Oil Burners

High and Low Pressure Oil Burners
Gas Burners, Combination Oil and Gas Burners

Complete Oil Systems installed.

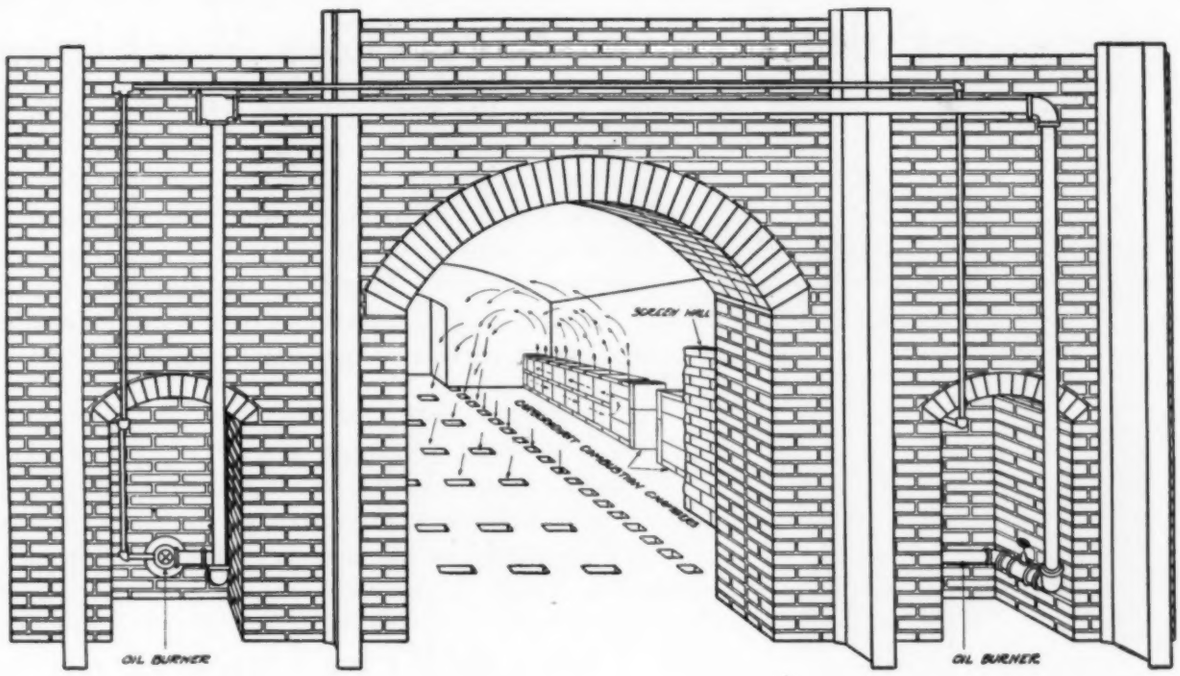
Interesting Catalogs of Oil Burning Equipment or Industrial Furnaces Sent Upon Request

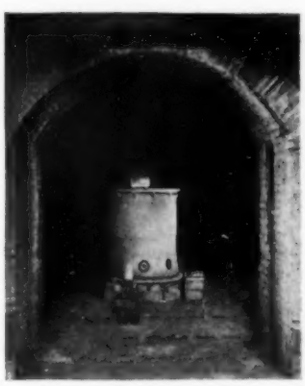
DEMPSEY FURNACE DIVISION

W. N. BEST Corporation

Engineers and Manufacturers Since 1890

11 Broadway, New York City





Fire your Kilns by the Carboradiant Method

THE Carboradiant Combustion Chamber represents a real advancement towards perfecting kiln burning conditions.

This new method can be applied to existing kilns or to new construction for firing either by oil or gas and it provides—

A greatly simplified construction and system of firing.

A saving of fuel—20% or more.

A reduction in the number of burners—only two or four needed.

A better temperature control.

A reduction in burning losses and maintenance costs.

This new development is made possible through the use of Carbofrax, the Carborundum Refractory.

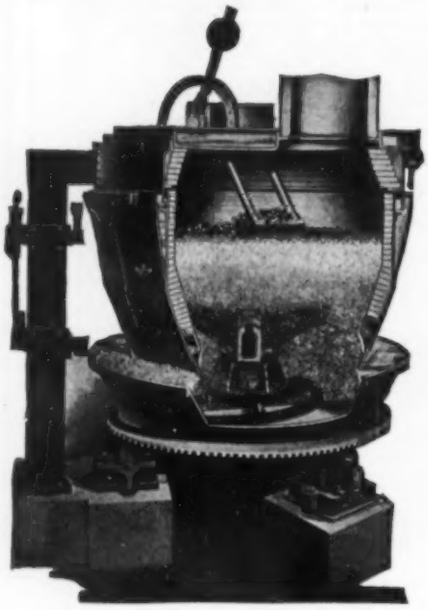
Write our Sales Engineering Department for the complete details.

Carborundum Refractories

Brick and Tile for Boiler and Furnace Settings; Muffles for Enameling Furnaces; Hearths for Heat-Treating Furnaces; Cements for all High Temperature work.

THE CARBORUNDUM COMPANY, PERTH AMBOY, N. J.
REFRACTORY DIVISION

Morgan Pokerless Producer-Gas Machines



have stood the test of service without radical change of design for eleven years. Notwithstanding repeated changes to other types of Mechanical Gas Producer the Morgan still remains supreme in RELIABILITY and freedom from hard labor. This background of continuous service gives the purchaser of these splendid machines a certainty beyond price.

Our noiseless steam jet-blower is the most efficient and most welcome improvement in Gas Producer operation which has been introduced since the discovery 13 years ago that a gas-making fire should be continuously levelled but not poked.

Over 600 in Operation

Morgan Construction Company, Worcester, Mass.

Chicago Office: 1361 Peoples Gas Bldg.

THE BABCOCK & WILCOX COMPANY

85 LIBERTY STREET, NEW YORK

Builders since 1868 of Water Tube Boilers of continuing reliability

BRANCH OFFICES

BOSTON, 49 Federal Street
PHILADELPHIA, Packard Building
PITTSBURGH, Farmers Deposit Bank Building
CLEVELAND, Guardian Building
CHICAGO, Marquette Building
CINCINNATI, Traction Building
ATLANTA, Candler Building
PHOENIX, ARIZ., Heard Building
DALLAS, TEX., 2001 Magnolia Building
HONOLULU, H. T., Castle and Cooke Building
PORTLAND, ORE., 805 Gasco Building

THE BABCOCK & WILCOX COMPANY — STEAM

WORKS

Bayonne, N. J.
Barberton, Ohio

Makers of Steam Superheaters since 1898 and of Chain Grate Stokers since 1893

BRANCH OFFICES

DETROIT, Ford Building
NEW ORLEANS, 344 Camp Street
HOUSTON, TEXAS, Southern Pacific Building
DENVER, 435 Seventeenth Street
SALT LAKE CITY, 405-6 Kearns Building
SAN FRANCISCO, Sheldon Building
LOS ANGELES, 404-6 Central Building
SEATTLE, L. C. Smith Building
HAVANA, CUBA, Calle de Aguiar 104
SAN JUAN, PORTO RICO, Royal Bank Building

METTLER

Entrained Combustion

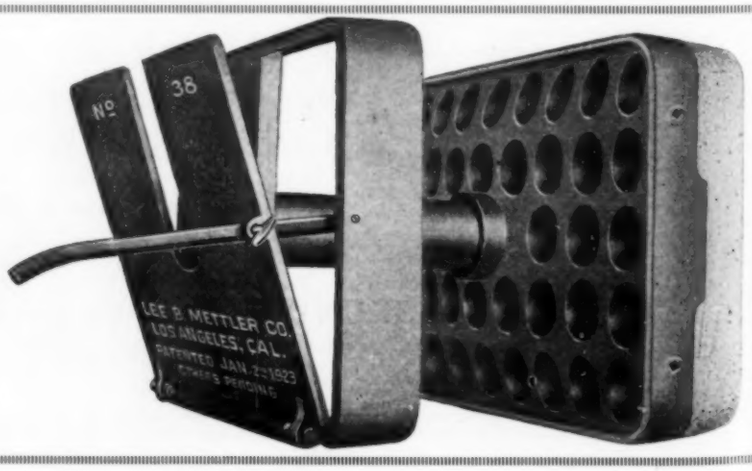
GAS BURNERS

FOR ALL { Purposes / Pressures / Kinds of Gas

If it is a gas burning problem—we can solve it for you.

Send for new condensed catalogue.

LEE B. METTLER CO.
406 South Main St., Los Angeles, Calif.

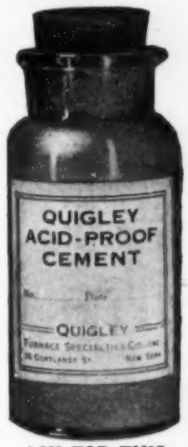


Ask for a sample of

QUIGLEY ACID-PROOF CEMENT

QUIGLEY ACID-PROOF CEMENT is a ready mixed acid resisting cement and protective coating. It resists strong, weak and mixed solutions of Sulphuric, Nitric, Hydrochloric, Phosphoric and other corrosive acids.

It is a smooth plastic preparation, evenly blended by machinery with all ingredients in correct proportions. It saves the laborious and uncertain compounding that is required in the case of dry cements and it sets up hard at ordinary atmospheric temperatures.

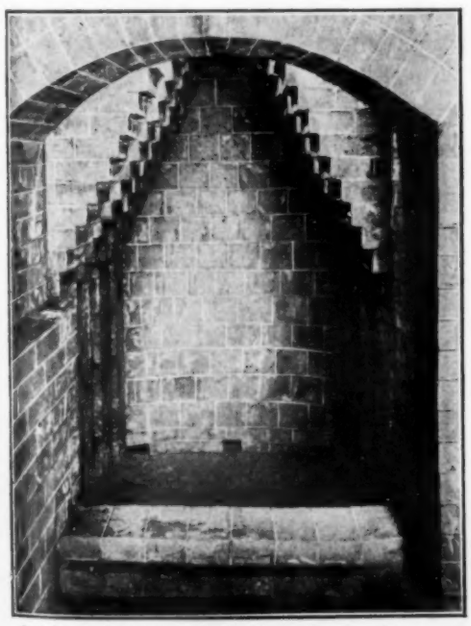


ASK FOR THIS 8 OZ. SAMPLE

Apply a small quantity on both sides of strips of glass such as microscope slides. Dry for 24 to 48 hours and then stand the strips for test in beakers of acid solutions.

How Used

Quigley Acid-Proof Cement is used as a mortar or binder in the construction of acid-proof masonry and as a protective coating. Thin joints are used. The brick or tile are buttered and tamped to a close fit leaving joints flush with brickwork.



Acid-proof brick and hollow tile in this tower base laid up with Quigley Acid-Proof Cement.

Where Used

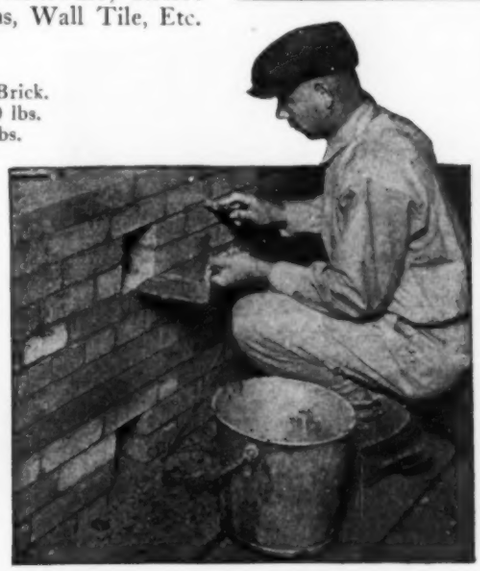
Quigley Acid-Proof Cement is used for laying up and surfacing masonry in acid towers, tanks and vats, and for laying up masonry where acid fumes are encountered. It is also used for miscellaneous equipment such as, Acid Chutes, Chimney Linings, Cooler Linings, Condensers, Digesters, Fan Casings, Floors, Flue Linings, Floor Tile, Fume Lines, Gasket Coating, Gutters, Pipe Joints (terra cotta and stoneware) Retort Linings, Stacks, Troughs, Wall Tile, Etc.

Quantity Required:

To Lay 1000 Acid-Proof Brick.
9 x 4½ x 2¼ standard 400 lbs.
8 x 4 x 2¼ standard 350 lbs.

Shipped In:

100 lb. cans, 225 lb., 400 lb., and 800 lb. drums.

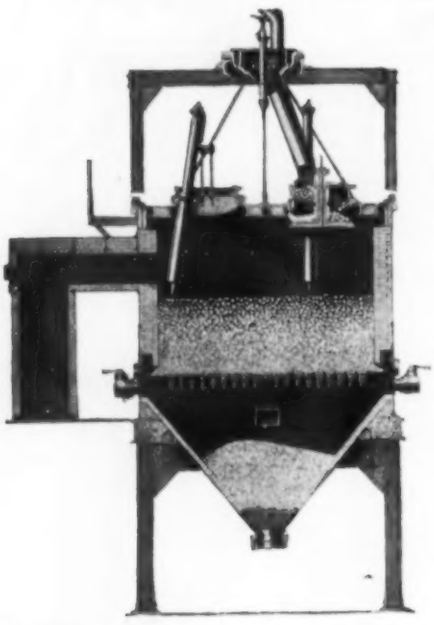


Quigley Furnace Specialties Co., Inc.

26 Cortlandt Street — *Makers of* HYTEMPITE — New York, N. Y.

Distributors with Stock and Service Men in Every Industrial Center

You can heat better with gas—and the cheapest gas is Producer Gas



Thirteen Smith Gas Producers of the size and type shown here are installed in one plant. They produce over 70,000,000 cu.ft. of clean producer gas daily.

The gas is distributed through several miles of piping and used for heat treating, cyaniding, brazing, forging, glass melting and the operation of gas engines.

The same purchaser owns several other factories in which Smith Gas Producers are used. The twelfth repeat order has just been received from this one concern for this type of equipment.

This is the best evidence we can submit to prove that Smith Gas has many advantages over oil, city gas and other fuels.

Ten years' experience with Smith Gas has convinced our customer of the merits of clean producer gas as a general purpose fuel.

Submit your fuel problem to us now as others are doing. We have more active prospects for the sale of our equipment than at any time for several years.

SMITH GAS ENGINEERING CO., DAYTON, OHIO

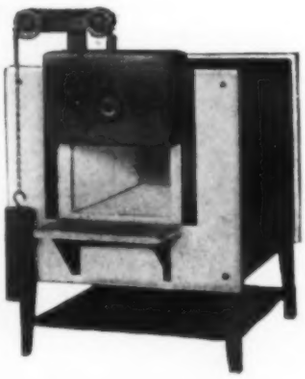
Vincent-Gilson Engr. Co.
30 Church St.
New York, N. Y.

Burnham, Bland & Lindsey
208 South La Salle St.
Chicago, Illinois

Castle & Wilson
1601 Arrott Bldg.
Pittsburgh, Penn.

A. H. Savage
Pioneer Bldg.
St. Paul, Minn.

THAT'S ALL WE DO



We have spent 14 years building electric laboratory equipment and electric furnaces from the size pictured above to furnaces of 10 ton capacity.

HEVI DUTY ELECTRIC COMPANY
"Hevi-Duty" and "Multiple Unit" Furnaces
MILWAUKEE, WIS.

NEW YORK
BUFFALO
CLEVELAND
CHICAGO

Formerly
Electric Heating Apparatus Co.
Newark, N. J.

DIXON

Assay Crucibles and Metallurgical Clay Goods Bearing the Dixon Name

DIXON
Assay Crucibles
Wonder Cupels
Scorifiers
Muffles
DIXON-MADE

There are none better for your metallurgical laboratory. DIXON experience in the manufacture of metallurgical graphite and clay products dates back nearly a century. Because of this, experience takes the place of guesswork and the DIXON name on metallurgical clay and graphite goods is your guarantee.

Let your next order of crucibles, cupels, scorifiers, muffles, be DIXON-MADE. *Write for Booklet No. 243-AA.*

JOSEPH DIXON CRUCIBLE CO.
Jersey City **New Jersey**
Established 1827

D X N

LAWTON PROCESS VICTORY B-42 CRUCIBLES

are available for all applications

THE VICTORY line of graphite Crucibles includes every type:

Tilting Oil Furnace Crucibles—Tilting Coke Furnace Crucibles—Rolling Mill Crucibles—Crucibles for Melting Steel—Plumbago Retorts—Prolongers or Condensers—Graphite Phosphorizers, etc., etc.

"Wise Buying Pays"

So, no matter what your crucible application may be, you can take advantage of the longer crucible life and unrivaled economy made possible by VICTORY Crucibles and the famous Lawton formula that governs their manufacture.

VICTORY gives not only longer but also a more *uniform* length of service. You can figure your replacement costs with surprising accuracy—and your money-savings with astonishment, if you have not used VICTORY before. Let us send you interesting figures on the economies enjoyed by VICTORY users in your own industry.

Tells All About Crucible Use in Modern Furnace Practice.
This valuable book—containing a wealth of profitable information—is sent free to you at your request.
JONATHAN BARTLEY CRUCIBLE COMPANY

JONATHAN BARTLEY CRUCIBLE CO.
Trenton, N. J.

FRANCIS WAGNER
Martin Bldg., El Paso, Texas

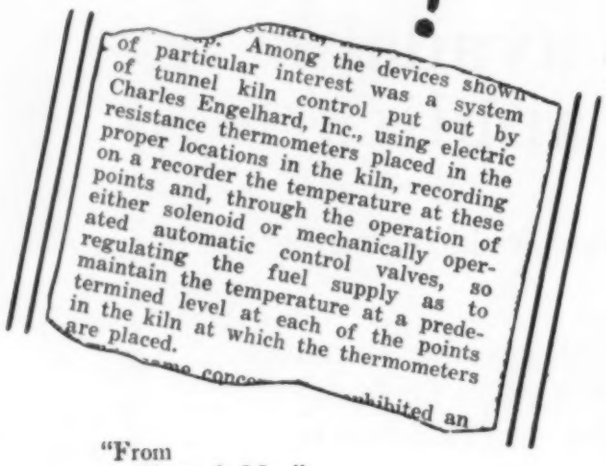
A. C. MOULTON
206 S. W. Temple, Salt Lake City, Utah

E. D. BULLARD CO.
565 Howard St., San Francisco, Cal.

BRAGG ENGINEERING CO.
11-252 General Motors Bldg., Detroit, Mich.

W. T. WITHERS SUPPLY CO.
926 Atlanta Trust Co. Bldg., Atlanta, Ga.

Automatic
Temperature
Control
at its best !

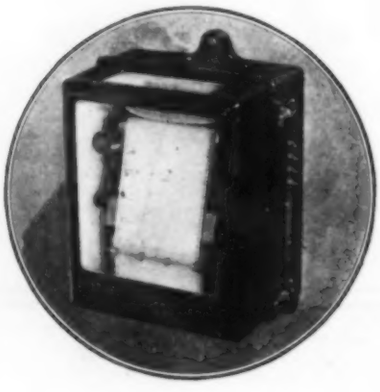

of particular interest was a system of tunnel kiln control put out by Charles Engelhard, Inc., using electric resistance thermometers placed in the proper locations in the kiln, recording on a recorder the temperature at these points and, through the operation of either solenoid or mechanically operated automatic control valves, so regulating the fuel supply as to maintain the temperature at a predetermined level at each of the points in the kiln at which the thermometers are placed.

"From
Chem. & Met."

A TEMPERATURE control system is no better than the efficiency of its various units. In Engelhard Thermo Electric Pyrometers, Electric Resistance Thermometers, Thermostats, Valve Regulators, Circuit-Breakers and Relays, etc., you have a group of devices each of which has won the highest possible distinction in its field. Engelhard Automatic Temperature Control and Regulation Systems have demonstrated their usefulness and economy in many a Process plant. The various types are adapted to temperature control of high pressure oil systems—high pressure single valve gas systems — low pressure two-valve gas systems — electric furnaces (including use for any pre-determined temperature curve)—steam heated plates—refrigeration systems; also *pressure control* of steam, gas boosters, vacuum lines; as well as for regulaton in certain Electrical Processes. *Address*

CHARLES ENGELHARD, Inc.
30 Church St., New York

ENGELHARD CONTROL



A medium priced

AUTOCLAVE

that is well built.

Seamless drawn steel pot, eleven inches deep, in three diameters, six, eight and ten inches. Tested to a thousand pounds and fitted with a pop safety valve, steam gauge, and thermometer well. Made in our plant, which means quality throughout.

Buffalo Dental Manufacturing Co.
Lock Box 979, Buffalo, N. Y.

IMPROVE SERVICE
and
LOWER COST
by using

Rockwell Air-Tight Blast Gate

There are many control operations in which the ordinary valve is unsuitable, due to high cost, size, slow action, replacement of parts, clogging, etc. You can avoid these handicaps by installing inexpensive, simple, compact, quick-acting Rockwell Air-Tight Blast Gate.

Rockwell Air-Tight Blast Gate Flanged Connections, Hand Lever Operating Mechanism.

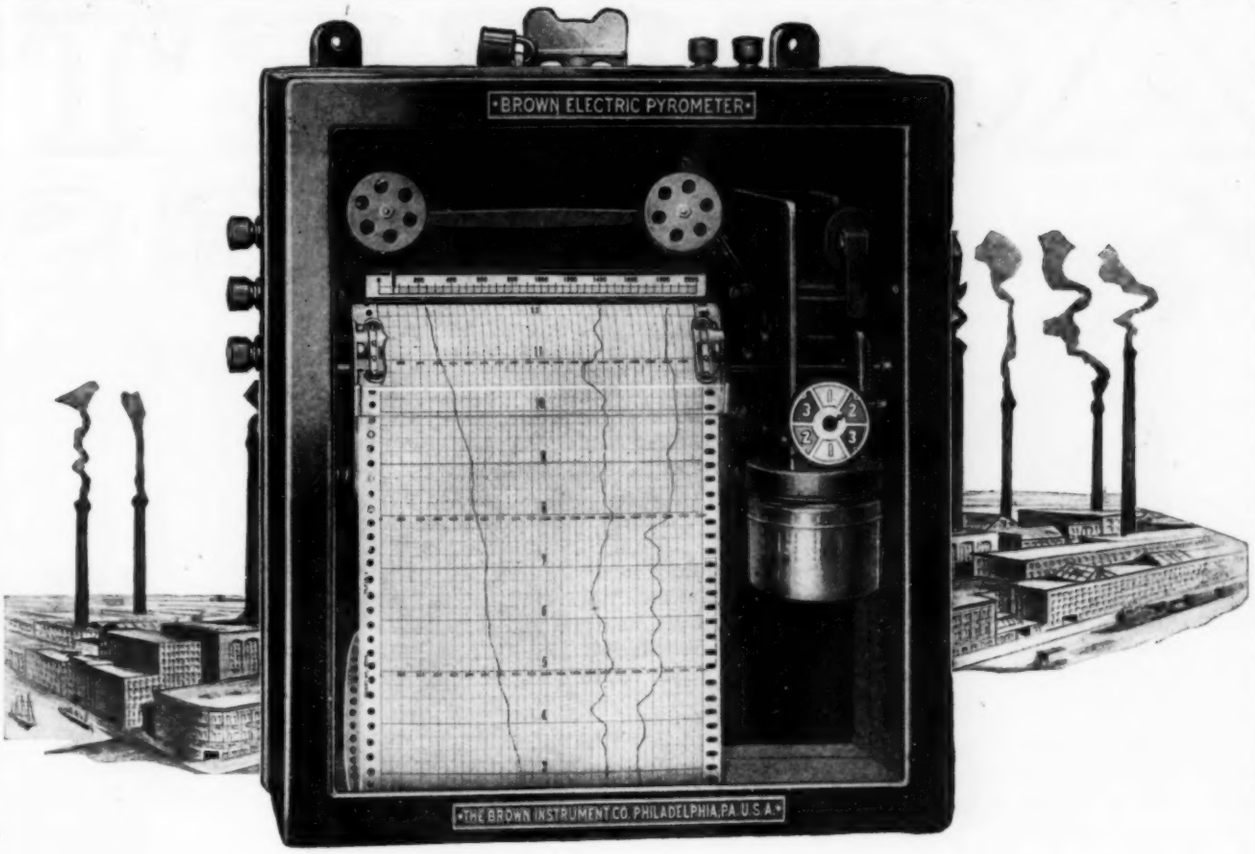
This novel control device has proven, in actual use, that it is economical and efficient for operations ranging from the control of air to the control of powdered coal, starch, paint, etc., as illustrated in Bulletin 262-E.

Write nearest office for copy.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St. (Hudson Terminal Bldg.)New York

CHICAGO 537 S. Dearborn St. | CLEVELAND Union Trust Bldg. | DETROIT Majestic Bldg.

Canadian Distributor: Drummond McCall & Co., Ltd., Montreal.
British Representative: Gibbons Bros., Ltd., Dudley, Worc., England.



8 New Recorder Features

Fully covered by Brown U. S. Patents. No other recorders can have these eight big features:

1. Operating mechanism mounted on swinging frame for easy inspection.
2. Automatic ribbon shift insures complete visibility of single and duplex records.
3. Multiple records in contrasting colors, with automatic switch identifying each active couple with respective record.
4. Quick-return depressor. Reduces pivot load.
5. Transparent tear-off. Does not obscure record. Recorder construction permits record to be torn off soon after completion.
6. Hand-support for writing notes on chart. Convenient.
7. Flexible pointer with vibration eliminator.
8. Improved automatic cold junction compensator (with zero indicator) for pyrometers.

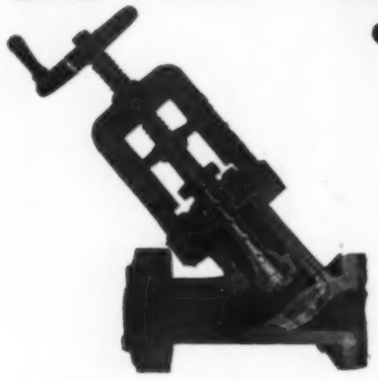
Note: Brown New Design Continuous Chart Recorders are furnished with Brown Pyrometers, Pressure Gauges, CO_2 Meters, Thermometers and Tachometers, as desired. Let us mail you catalogs of any instruments which interest you, also complete information on the savings which you may expect through the use of Brown's.

THE BROWN INSTRUMENT COMPANY
4629 WAYNE AVENUE, PHILADELPHIA, PA.

Brown Continuous Chart **Recorders**

141

ACIMET VALVES



They stand the "grief"

The alloy used in these valves is highly resistant to sulphuric acid—in all degrees of dilution—and is correspondingly successful with other corrosive solutions.

The body is one solid casting of Acimet (special hard-lead alloy). They do not leak—they do not clog.

Our Freflo Valve (above) furnishes an absolutely unobstructed free-flowing outlet to solutions. It will help you smooth the way to better results, when you have heavy solutions to handle. Notice the reinforced stem and seat in the above sectional view—another reason why our valves "stand the grief."

Pictured at the right is our Acimet Check Valve Perpendicular Type.

Our catalog has many other facts—send for it.

The Cleveland Brass Mfg. Co.
4612 Hamilton Ave., Cleveland, Ohio
Pacific Coast Office: 558 Howard St., San Francisco, Cal.

Remove Paint with Speed and Economy

THE CP Superior Paint Scraper illustrated is being used by the Providence Paint Spraying Corporation, Providence, R. I., for removing paint from a gas holder.

This efficient tool is proving speedy and economical for cleaning and paint removing in gas companies, railroad shops, ship yards and manufacturing plants.

The CP Superior Paint Scraper has only three parts—cylinder, piston and inlet piece. Simplicity of construction assures proper and economical operation. The extreme accuracy with which all parts are machined prevents air losses and secures a free, effective blow, at the same time guaranteeing absolute interchangeability of all parts in tools of like size.

Let us show you how this method of removing paint will save you time and labor. Ask for a demonstration under your own working conditions.

Chicago Pneumatic Tool Co.
Sales and Service Branches all over the World
6 East 44th St., New York, N. Y.

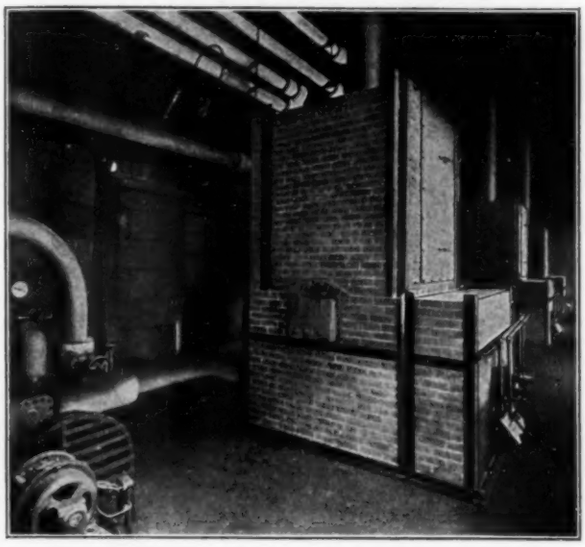
P-244½

High Temperature-Low Pressure Heating

Lesson No. 16

In which we try to tell you why Merrill Process has many endorsers but few testimonials

The Secret Is Out!



I'm going to let you in on something. We've made a lot of installations, which include most of our biggest and best, and about which I have taken a solemn obligation not to tell where they are. Yes sir, I must not print or paint, stamp or engrave anything that will reveal their location.

What is the idea behind all this? Is it merely a passing whim or fancy? Well I might consider it so if we were handling Millinery or Beauty Parlor Supplies and were dealing with the capricious half of the human family, but we're not. It's men like yourself who demand this privacy—in fact they call it protection.

Consider the case of a certain Dry Battery Manufacturer. He dared—that is he had the nerve to pioneer in this field. It cost him many dollars before he knew what his results were going to be. He has a plant now that is a plant. No more mess and dirt—no more burned compound—no more ladling—just a sweet clean process with compound prepared in real kettles and carried to the point of consumption through piping and valves that are also oil heated. They say: "We cannot permit anyone to inspect our plant."

Another Company making a Synthetic Lard Compound says: "Please do not mention our name in your advertising." You ask "Why"? Well I'll just tell you this much. This company makes in my estimation the best Compound on the market—you know the kind that puts the pep and flakiness into the pie crust so that you just burst all rules of etiquette by jumping up and giving the wife a real kiss—and then bring her a box of candy the next day—Oh Boy. Well part of that quality is due to a system of heating that allows perfect control during the whole deodorizing process.

A large Company, known the world over, says: "We're sorry but we cannot let you photograph the installation." "Why"? Well it's the same reason—they have secured quality and dependability by using a system that removed the tares from their process and left only the wheat. They manufacture electrical equipment. Other manufacturers watch them to see which way they jump—then follow in the same direction. It certainly is an envious position to hold. It's the Grand Prix stamp of approval. It's a great feeling of satisfaction that comes over us when we vote for a winner—even though we did wait to see who the big fellow would pick.

Once a manufacturer of a Special Varnish investigated thoroughly the merits of Industrial Heating by Oil Circulation and declared the sample produced in actual test to be all that could be desired. Then he wavered. You know the story, "He who hesitates doesn't get there first." He said if I could get some one else to install a system and then come back and tell him then he would give me an order. I was to try it out on the dog—a very ancient idea. Well some one else did adopt it with the distinct understanding that we would not advertise the fact, so that he who had a chance to take the lead, with equal pleasure to himself and honor to his industry, is trailing instead.

There's a reason behind all this and here it is. They judge the value of articles for themselves. Instead of following the industry they are out in front. That's why they are where they are. They have courage and they use it. Don't forget: "Any old bird can stay close to the ground, but it takes an eagle to soar over the mountains."

Surprise party for you next month

Parks-Cramer Company

Engineers and Contractors - - Industrial Piping and Air Conditioning

1102 Old South Building, Boston, Mass.

Represented in England and on the Continent by The Kestner Evaporator & Engineering Company, Ltd., London, England

"Here are the figures!"

Plant Engineer: "They show the results of the test made of the piece of ACE hard rubber pipe, the American Hard Rubber Company sent us—It is resistant to:

Sulphuric Acid,	50° Be′;	specific gravity, 1.516
Hydrochloric Acid,	24° Be′;	specific gravity, 1.19
Nitric Acid,	16° Be′;	specific gravity, 1.12
Acetic Acid,	7.5° Be′;	specific gravity, 1.055

Citric Acid, any strength
Caustic Soda, any strength
Hydrogen Dioxide, any strength
Copper Sulphate, any strength
Hydrofluoric Acid

Beside that, they manufacture various special compounds for any particular requirements we may have. It doesn't seem to me we can beat these figures with anything else. What do you think?"

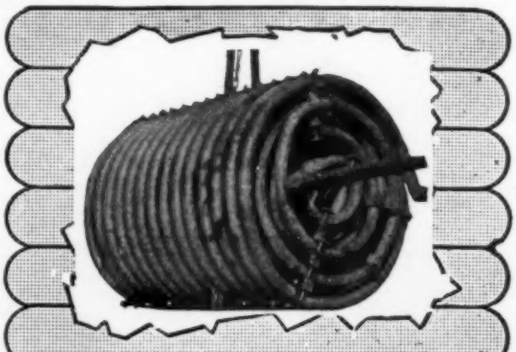
Plant Superintendent: "No, — but — what about price?"

Plant Engineer: "The initial cost is a little higher but when you consider the upkeep charges we have had with metal piping the difference in cost is slight—if there's any difference at all. I'm convinced it's the only thing that will resist the strong corrosive acids we use."

American Hard Rubber Co.

11 Mercer Street, New York, N. Y.

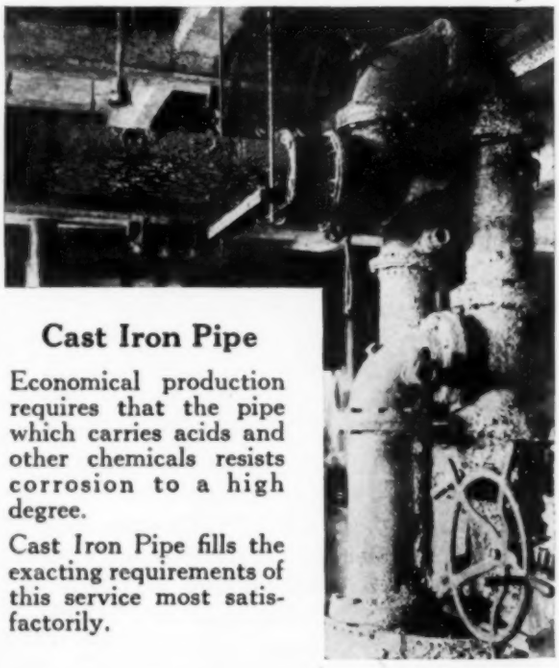
Manufacturers of
moulded parts for all industrial uses.



CHEMICAL PLANTS, coke ovens blast furnaces, soap factories, brine and ammonia circulating systems represent only part of the extensive field served by "ALBRIGHT" Coils and Pipe Bends. Made of steel or wrought iron—with knowledge and craftsmanship acquired during over half a century's experience! Write for our unusual Co-operation Plan.

"SINCE 1865"

ALBRIGHT SON & CO.
COIL AND PIPE BENDERS
ALLENTOWN, PENNA.



Cast Iron Pipe

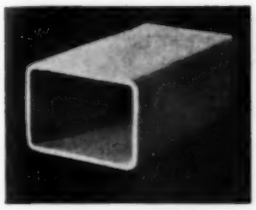
Economical production requires that the pipe which carries acids and other chemicals resists corrosion to a high degree.

Cast Iron Pipe fills the exacting requirements of this service most satisfactorily.

United States Cast Iron Pipe and Foundry Company

SALES OFFICES:
Philadelphia, Chicago, Birmingham, New York, Buffalo, San Francisco, Pittsburgh, Dallas, Kansas City, Cleveland, Minneapolis

General Offices
Burlington, New Jersey

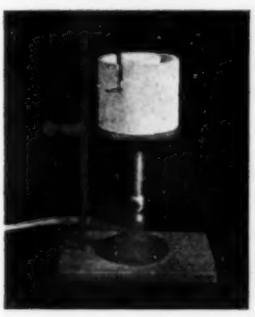


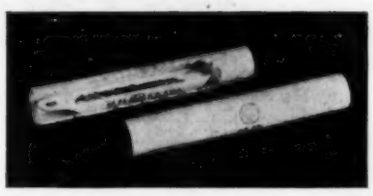
Alundum and Crystolon Refractory Laboratory Ware

Alundum and Crystolon laboratory crucibles, dishes, filter cones, thimbles, muffles and tubes are made of electric furnace refractory products (fused alumina and silicon carbide).

Write for free catalog describing and illustrating these articles in detail.

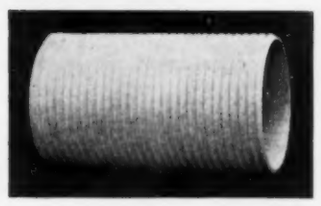
Booklet on the construction of Laboratory Electric Furnaces and leaflet on Refractory Cements are also available.

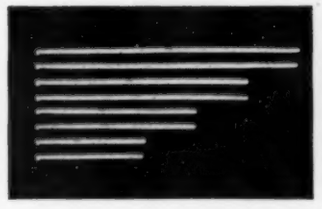




Norton Refractory Laboratory Ware and Accessories are supplied by many apparatus and chemical supply dealers.

R-263





NORTON COMPANY, WORCESTER, MASS.

This Was The Record Furnace Roof-575 Heats

A Similar Roof Has Since Made 630 Heats. Both were lined with

GENERAL REFRACTORIES BRICK

IN a middle western foundry,* noted for the high quality of its special steel castings, the average life of their Moore 3-ton electric furnace roofs was 450 to 500 heats.

The roof shown at the left ran 575 heats. A similar roof has since made 630 heats. Both of these roofs, and the side walls of the Moore electric furnaces, were lined with General Refractories Brick.

For electric furnaces, open hearths, blast furnaces, cupolas and all types of forging and heating furnaces, there is a General Refractories brick which we believe will give you longer and more economical service.

A General Refractories man will help you select just the right refractories for your conditions. He knows refractories and his recommendations are not limited by manufacturing facilities, for General Refractories Company produces fire clay brick manufactured over all known processes — hand made, machine made, dry pressed and the now famous G. R. Co. sizing process — as well as silica, chrome, magnesite and high alumina refractories.

May we help you reduce refractory costs?

*Name of foundry on request.

GENERAL REFRACTORIES COMPANY

117 South 16th Street, Philadelphia, Pa.

District Offices: Boston Buffalo Chicago Cleveland Detroit Indianapolis New York Pittsburgh
Pacific Coast Representative—Richard S. Jensen Co., Los Angeles, California
Canadian Representative—Webster & Sons, Ltd., Montreal, Canada

Works—Baltimore, Md. Beech Creek, Pa. Claysburg, Pa. Danville, Ill. Hitchins, Ky. Joliet, Ill. Karthaus, Pa. Mill Hall, Pa. Mount Union, Pa. Olive Hill, Ky. Orviston, Pa. Rockdale, Ill. Sandy Ridge, Pa. Sproul, Pa. West Decatur, Pa.

McDanel Refractory Porcelain Pyrometer Tubes and Protection Tubes

Years of experience in the refractory porcelain business plus a large number of tests of actual operation assure you that McDanel Products are right in every respect. In these tests, McDanel Tubes have proven to be far superior to various other makes. It will pay all pyrometer users to specify McDanel Tubes with their instruments or next replacement order from their instrument makers.

We have also developed a very successful porcelain combustion tube for carbon determination and a porcelain combustion boat which has met with marked success.

TRADE MBM MARK

Write for complete information on McDanel Products.

McDanel Refractory Porcelain Co.
Beaver Falls, Pa.

MONARCH

of

Brass—Iron—Steel
Rubber—Stoneware,
Etc.

for

Any Acid or Gas

Write For Catalog 6-C

Monarch Mfg. Works, Inc.
2730 E. West Moreland St.
PHILADELPHIA, PA.

SPRAYS

The most varied types of chemical stoneware Faucets and Fittings
—representative of the unsurpassedly large G-C line—are illustrated and described in this free Bulletin C. Write for copy.

G-C EXAMPLES of Fine Precision

Faucets and Fittings

manufactured by G-C, reflect not only well-conceived designs—adapted to a wide range of practical uses—but also are made from specially selected and prepared clays, the body having a very fine, hard and dense texture.

They are incorrodible and practically indestructible. Where great cleanliness and preservation are essential, as in the handling of foodstuffs, pharmaceuticals, etc., they are invaluable. Special safety devices give them an extra margin in safety factor, for the handling of dangerous corrosives.

Bulletin C is fully descriptive. Write for this or any other Bulletin on whatever kind of High-Grade Chemical Stoneware you are interested in.

Fig. 184-a
Three-Way-Y Flanged Ends

Fig. 178
Bibb Flanged End

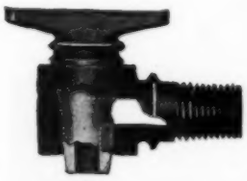


Fig. 177
Right Angle Threaded End

Fig. 188
Bibb with Spray Catcher Threaded End

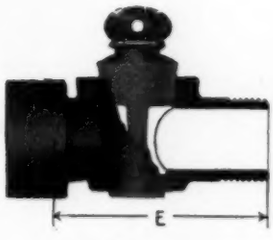


Fig. 337
Gas Faucet

Fig. 273
Armored Right Angle

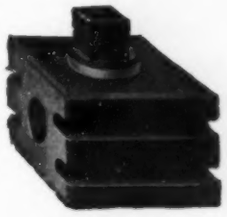


Fig. 520-a
Four Bolt Block

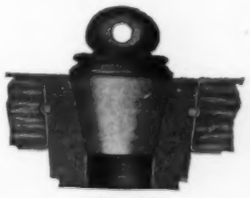


Fig. 173
Tank Plug

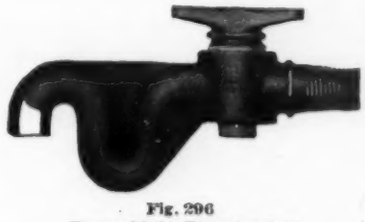
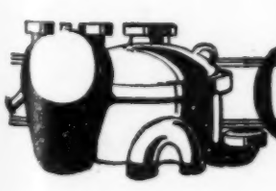


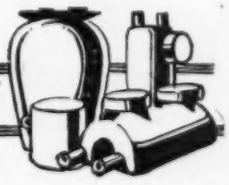
Fig. 296
Trapped Bibb Threaded End



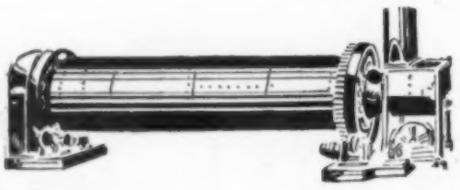
GENERAL CERAMICS COMPANY

50 CHURCH STREET NEW YORK CITY

Western Sales Office: 830 Monadnock Bldg., San Francisco

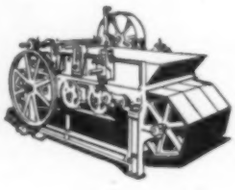


LOUISVILLE
ROTARY DRYERS



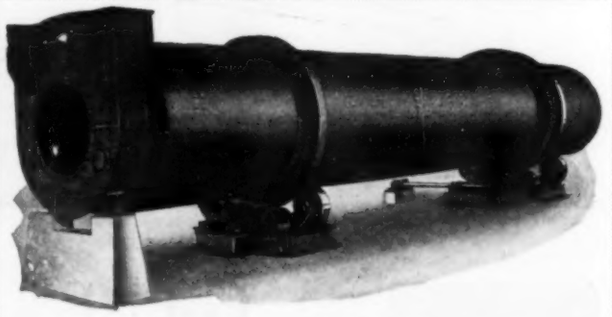
Whether you require a coal, oil or gas-fired rotary, an indirect steam-heated air dryer for crystals or delicate materials, or a dryer in which steam tubes can do the work, here is the place to obtain just what you need. In every case you are assured of the highest efficiency and a guaranteed production.

LOUISVILLE
CONTINUOUS PRESS



Wood pulp, devulcanized rubber shoddy and similar materials can be dewatered by this machine continuously, with a surprisingly low cost for power. The true filtering action saves a high percentage of the finer particles.

LOUISVILLE
DRYING MACHINERY COMPANY,
Incorporated
451 BAXTER AVE. LOUISVILLE, KY.



THE "YORK" DRYER

has the approval of the operating engineers who know, through actual experience, how a Dryer should operate when drying coal, gypsum rock, rubber, sand, phosphate rock, chemicals and other materials.

All parts of a "YORK" DRYER are designed with a high factor of safety, thereby producing a machine which will operate for many years with a low maintenance cost, and the elimination of shutdowns for repairs.

Let us tell you in detail how you can *save money* by using *"YORK" Dryers.*

McGANN MANUFACTURING COMPANY, INC.
Engineers and Manufacturers
YORK, PA.

BRANCH OFFICES
30 Church St., New York, N. Y.
332 So. Michigan Ave., Chicago, Ill.

More Even Drying!

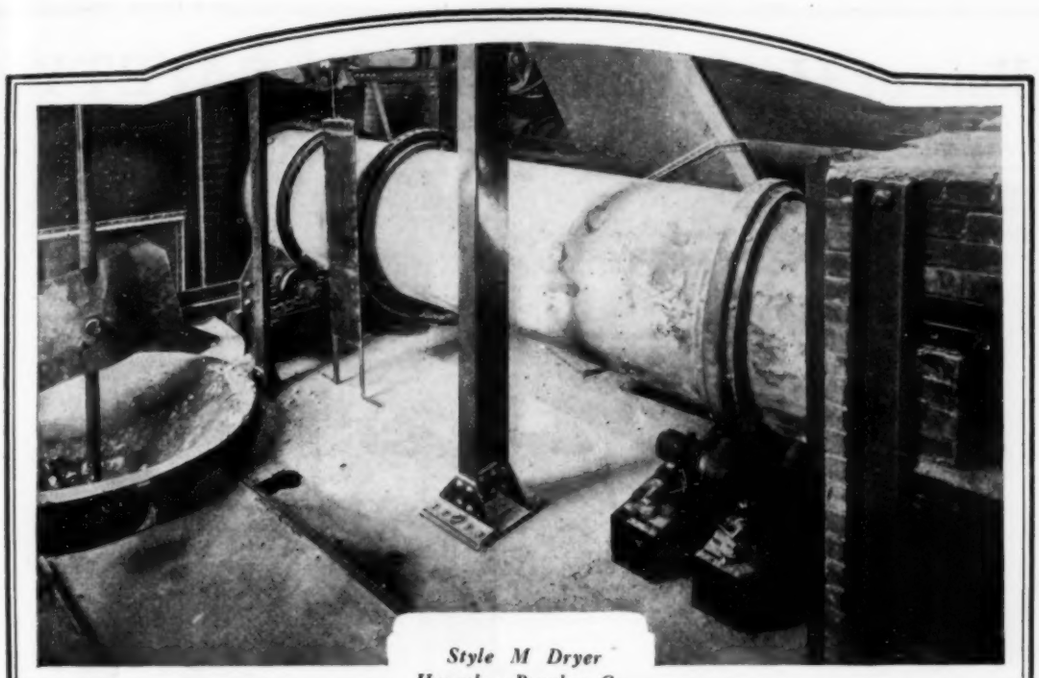
Uniform drying—every particle thoroughly and evenly dried—that's the boast of Monitowoc Dryers. And it is an earned one.

Wherever Manitowoc Dryers are in use regardless of the nature of drying they deliver the maximum amount of dried materials at a surprisingly low cost.

Let our engineers help you with your drying problems.

Manitowoc Engineering Works
Manitowoc, Wisconsin

MANITOWOC



Style M Dryer
Hercules Powder Co.
Baccus, Utah

When the Powder Mill Needs a Dryer

Powder mills, like other chemical plants, ask for dryers that are easy on fuel, reasonable in first cost and low in upkeep.

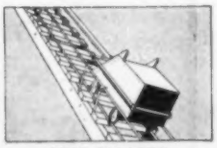
When dryers are needed, powder mills usually come to Bartlett & Snow. A list of the powder mills using our dryers for nitrate of soda and other chemicals reads like a directory of the industry.

Our Style M Dryer is particularly suited for this work. One company has put several of these dryers in operation in the last twenty-three years. Their records show that the average yearly upkeep has been less than $25.00 per dryer.

The features of this dryer are illustrated in our Bulletin 51, along with information on twelve other types of Bartlett & Snow dryers for many different materials.

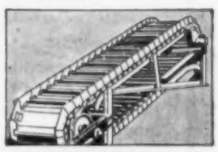
Our Engineers will be glad to have your drying problem put up to them. Just tell us the hourly tonnage, the percent of moisture and the desired dryness of the product. We'll take pleasure in submitting our recommendation. There is no obligation.

THE C. O. BARTLETT & SNOW COMPANY
6204 Harvard Ave., Cleveland, Ohio

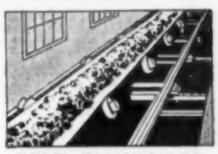


SKIP HOISTS

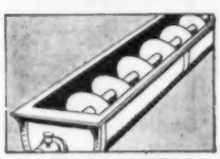
BUCKET ELEVATORS



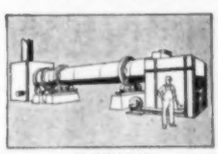
APRON CONVEYORS



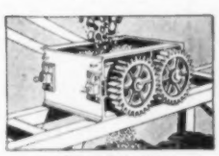
BELT CONVEYORS



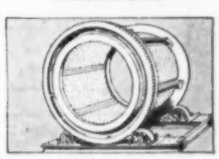
SCREW CONVEYORS



DRYERS



CRUSHERS



SCREENS

Bartlett - Snow

13 Standard Types DRYERS for Many Requirements

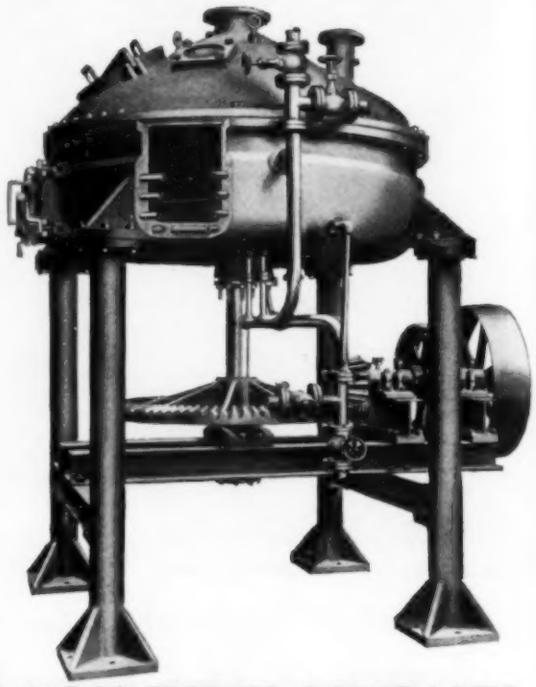
Higher Rate of Heat Transfer — Plus SAFETY

Why you should be interested in
Original Frederking Apparatus

FIRST—The possibility of using high pressure steam, increasing the over-all temperature difference and the rate of heat transfer.

SECOND—The ease with which alternate heating and cooling may be accomplished, with rapid cooling due to high velocity of the cooling medium.

THIRD—Leaks usually encountered in high pressure steam jackets, cannot occur in the Original Frederking construction.



FOR HIGHER TEMPERATURES than are within the range of available steam, consider the **BETHLEHEM HOT WATER SYSTEM.** This method of heating gives the same uniform temperature conditions as steam heating, and permits of temperatures up to 650° F. in the material being treated.

MATTER TO SERVE INDUSTRY

BETHLEHEM FOUNDRY & MACHINE COMPANY

(Send for Bulletin 500) **127 Front Street, Bethlehem, Pa.**

NEW YORK ENGINEERING COMPANY

DESIGNERS AND BUILDERS

OF CHEMICAL APPARATUS AND EQUIPMENT, VACUUM OR ATMOSPHERIC DRYERS, EVAPORATORS, IMPREGNATING, SATURATING AND SOLVENT RECOVERY APPARATUS, EVAPORATORS, VULCANIZERS, ETC., ETC.

WHAT IS YOUR PROBLEM? OUR ENGINEERS WILL COOPERATE WITH YOU.

MAIN OFFICE NO. 2 RECTOR STREET, NEW YORK CITY
WORKS: YONKERS, NEW YORK

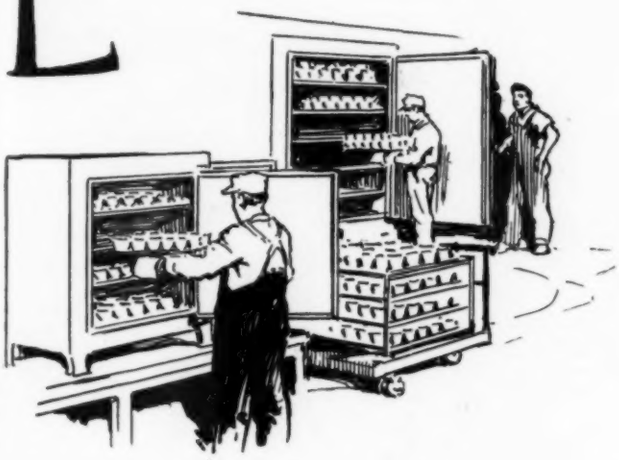
SPRACO NOZZLES

The nozzle shown is of special construction, made in many sizes, for use in connection with spraying tanks, gas scrubbers, etc. The thread above the hex can be screwed through the top or side of a tank and easily removed for inspection as all piping connections are on the outside. These nozzles are made of various materials, including bronze, cast iron, etc.

We will be glad to give complete information on receipt of details of your problem and send you Bulletin No. N-9.

SPRAY ENGINEERING COMPANY
BOSTON—MASS.

ENAMELING



Should it be a problem of *drying* instead of *composition* ?

THE drying or baking of enamels is traditionally a slow process. If carried on too rapidly, trouble occurs—a tendency to case-hardening and cracking, owing to difference of tensions.

Curiously enough, virtually all efforts to speed up process have been made in the direction of experiments with the contents or ingredients of the enamel itself, rather than with the drying equipment.

Yet the fact that it is a drying problem as much as that of enamel composition, is shown by the ability of the new Freas Industrial Ovens to substantially increase production.

This achievement is due chiefly to the ability of the remarkable Freas Thermo Regulator to provide absolute temperature control—holding any desired temperature to within ± 2 degrees, and affording instant response to any deliberate change.

Enameling or glazing may require at least a baking temperature of at least 1500° F. Freas Industrial Ovens, built to maintain heats up to 700° F., unerringly guide the gradual rise of drying temperature up to the point where the products are ready for the bake ovens.

A very considerable amount of time is saved in this operation by Freas Industrial Ovens —which, moreover, are decidedly inexpensive to install. The result is an attractive economy.

Write for interesting facts on the profitable use of Freas Industrial Ovens in *your* industry.

The Thermo Electric Instrument Co.
1206 So. Grove St., Irvington, N. J.

Interested in RUBBER AGING ?

The new Freas Rubber Aging Bath is by far the most satisfactory apparatus for tests involving the accelerated, artificial aging of rubber and like materials. Write for literature describing this apparatus or any equipment in the extensive Freas Laboratory Oven line.

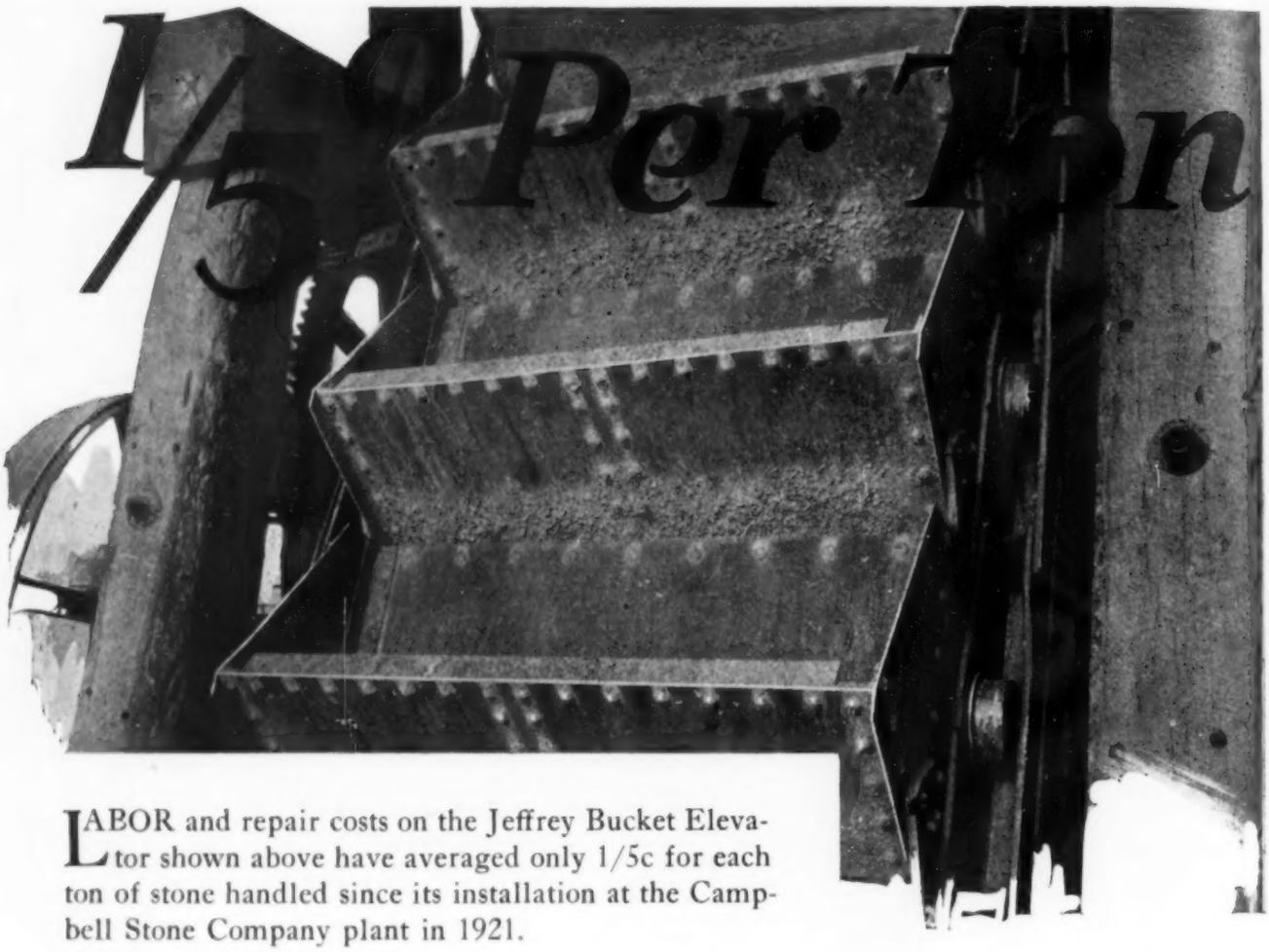
With Laboratory-Oven Accuracy

FREAS

Electric *Automatically Controlled*

INDUSTRIAL OVENS

1/5c Per Ton



LABOR and repair costs on the Jeffrey Bucket Elevator shown above have averaged only 1/5c for each ton of stone handled since its installation at the Campbell Stone Company plant in 1921.

The elevator, 40 ft. centers, has a capacity of 600 tons per hour. Heavy steel buckets with reinforced lips are mounted on Jeffrey 1076 Steel Thimble Roller Chain.

The hardened steel knuckles of the joints receive the enormous driving action of the sprocket teeth.

Hardened steel bushings thru the knuckles and fixed in the chain sidebar take the wear from the thru rods.

Large self-oiling bushed rollers assembled midway in the link carry the weight of chain and buckets, thus reducing power consumption and wear.

Plant of the Campbell Stone Company, Indian River, Michigan.

The Jeffrey Mfg. Co., 909-99 North Fourth St., Columbus, Ohio

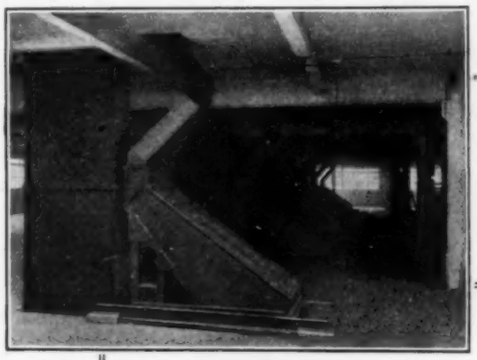
New York, Buffalo, Rochester, N. Y., Philadelphia, Pittsburgh, Scranton, Pa., Boston, Cincinnati, Cleveland, Charleston, W. Va., Chicago, Detroit, Milwaukee, St. Louis, Denver, Salt Lake City, Los Angeles, Birmingham, Charlotte, N. C., Montreal

JEFFREY
MATERIAL HANDLING EQUIPMENT

Jeffrey Products

Elevators—Conveyors
Portable Loaders
Coal and Ashes Handling Equipment
Skip Hoists
Chains and Attachments
Sprocket Wheels—Gears
Crushers—Pulverizers
Sand and Gravel Handling, Washing and Screening Equipment
Locomotives
Coal Mine Equipment
Tipple Equipment
Ventilation Fans

STURTEVANT



Professional vs. Amateur

Can the amateur compete with the professional in the design and construction of a plant assembly? i.e., the "Hook Up" of major machines with their auxiliaries (elevator, conveyors, screens, chutes, hoppers etc.) Can an amateur design and build such auxiliaries in competition either in cost or service, with the standard equipment of professionals? We say NO! and the proof is obvious. It is only necessary to inspect actual installations to be convinced. Compare the illustrations herein—they are not exaggerated. Both are installations of Sturtevant Screens.

Professional

The above picture speaks for itself. It is a standardized "Professional Unit," incorporating the results of experience in design, construction and arrangement. It is built for continuous service and economy. It is an investment, not an expense —It will endure.

Amateur

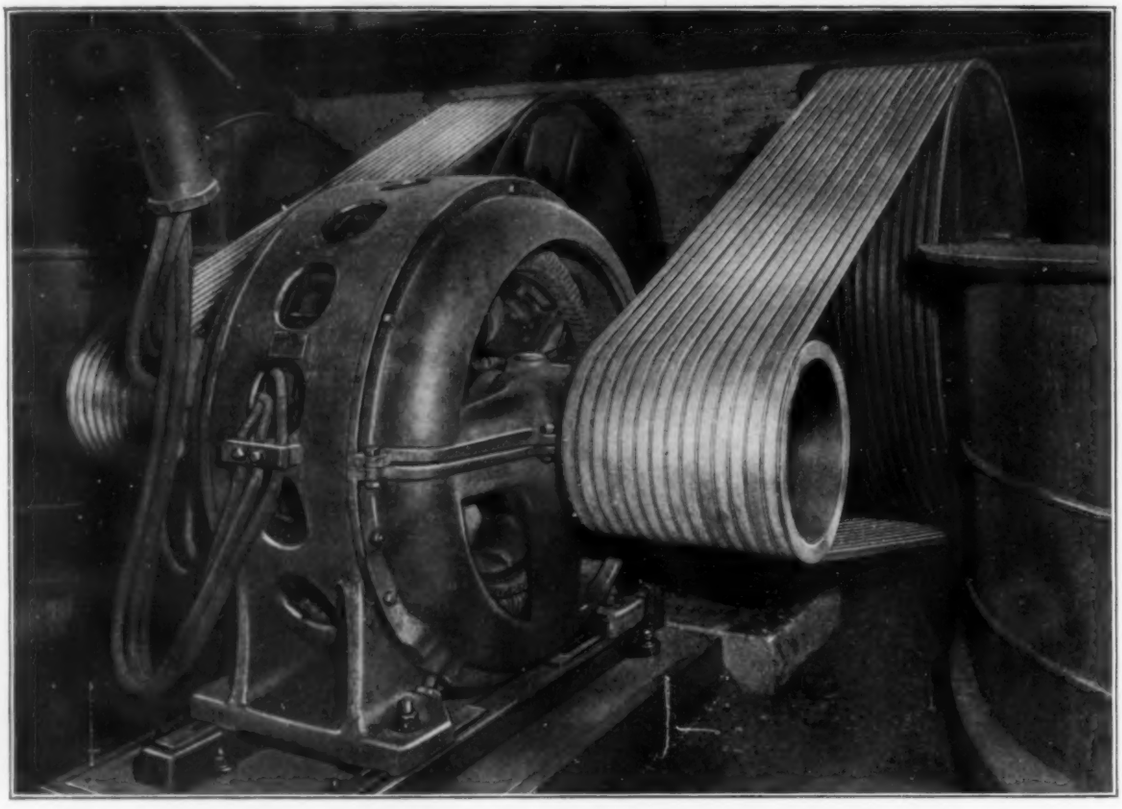
Again the picture speaks louder than words. The installation is crude, temporary, poorly conceived and executed—a bad investment—a constant expense and yet the owner thought he saved money by using home talent. Compare it with the "Professional Unit" shown above—Certainly such comparisons "Are odious."

Units

It is important that proper machinery be selected. That it be "Hooked Up" properly, and that auxiliaries be of a design, quality and kind to obtain an operating balance. Plant design, major machines and auxiliaries form the factory chain; be sure there are no weak links. Sturtevant experience, designs, equipment and service assure plant economy and are at your disposal when Crushing, Grinding, Separating, Elevating and Conveying problems are to be solved.

STURTEVANT MILL CO., HARRISON SQUARE BOSTON, MASS.

ALLIS TEXROPE DRIVE



The Proper Way to Drive Two-125 H.P. Beaters

The **TEXROPE DRIVE** came into the pulp and paper industry through an opening "Big as a Barn Door."

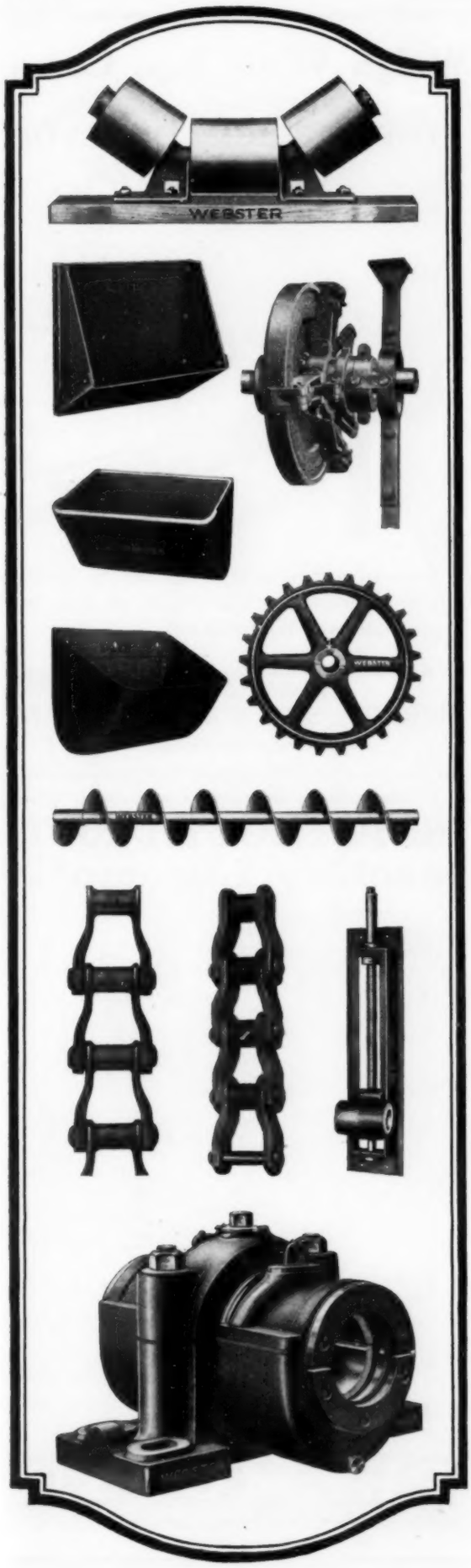
Because the industry needed, and did not have, a short center drive that was suitable for pulp mill conditions, that was not affected by moisture, that was positive, clean, trouble proof, silent and smooth, vibrationless and durable, the TEXROPE DRIVE, which HAS these characteristics, found a home.

Beaters, Jordans, Calender Stacks, Pumps, Fans, Stokers, etc.; fast or slow drives, wet or dry, hot or cold, clean or dusty, all are excellent TEXROPE applications.

Ask Our Nearest Office For Particulars.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.



Equipment for Every Handling Need

Whether your requirements are for chains, sprockets, elevator buckets, gears, bearings, hangers, friction clutches, elevator boots, or complete equipment for handling any class of material, you can turn to Webster as a dependable source of supply.

For half a century Webster machinery has been used for the handling of vast quantities of bulk and package materials in a wide variety of industries. During this period Webster equipment has saved untold hours of time, energy and labor and untold thousands of dollars.

Handling materials is constantly becoming a more mechanical proposition and Webster engineers would welcome an opportunity to consult with you as to how your own handling methods can be improved to enable you to lower the costs of production.

THE WEBSTER MFG. COMPANY
4500-4560 Cortland Street
CHICAGO

BOSTON.....902 Oliver Bldg.
BUFFALO.....572 Ellicott Square
CINCINNATI.....1914 Union Central Bldg.
CLEVELAND.....509 Swetland Bldg.
NEW YORK.....90 West Street
PHILADELPHIA.....719 Commercial Trust Bldg.
PITTSBURGH.....811 Magee Bldg.

WEBSTER-BRINKLEY COMPANY
627-669 Alaska Street
SEATTLE, WASH.

WEBSTER-INGLIS LIMITED
14 Strachan Avenue
TORONTO (2), ONTARIO

Largest in the World! —*also the smallest*

THE illustration shows one of the giant 10,000 hp. Baldwin-Westinghouse locomotives built for the Virginian Railways, also the 4½hp. midget locomotive used in various mining operations—the largest and smallest electric locomotives in the world.

Between these extremes Baldwin-Westinghouse builds many other sizes and ratings in trolley, storage battery and combination type electric locomotives.

All are designed to give unsurpassed service with lowest maintenance. All embody superiorities of construction that accrue from wide experience in locomotive building.

Consider Baldwin-Westinghouse when called upon to solve any haulage problem—these two companies combine more than a century of progressive experience.

Address either company

The Baldwin Locomotive Works
Philadelphia Pennsylvania

Westinghouse Electric & Manufacturing Co.
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of the United States and Foreign Countries

Baldwin Westinghouse

X87892

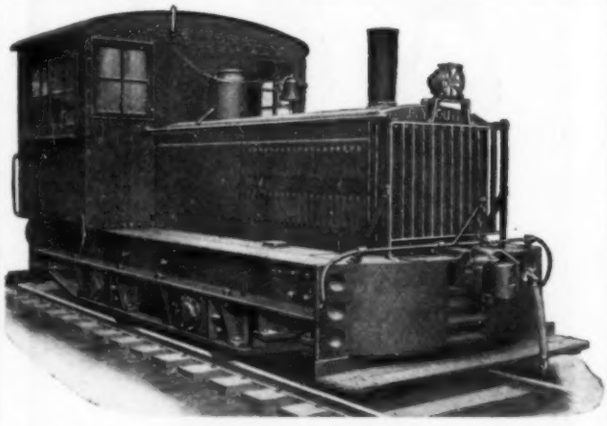
Weigh While You Convey over THE MERRICK CONVEYOR WEIGHTOMETER

Any material which is conveyor-handled can be weighed without additional handling or loss of time by the Merrick Conveyor Weightometer.

An Automatic—Continuous—Accurate Record

MERRICK SCALE MFG. COMPANY
186 Autumn St., Passaic, N. J.

The PLYMOUTH 20-Ton Gasoline Locomotive



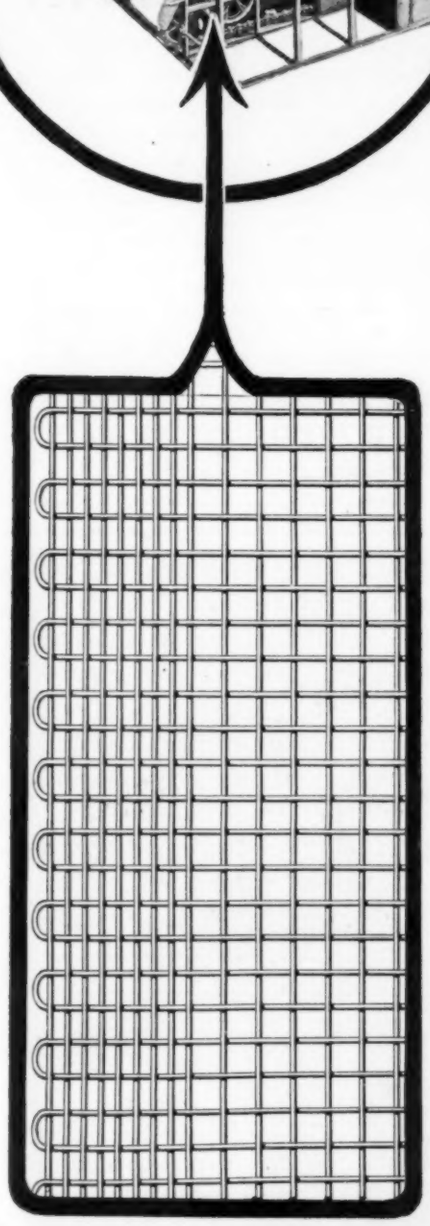
ESPECIALLY adapted to factory and general industrial haulage. Always ready, no coal or water to haul, no "stand by" expense, the Plymouth is cutting haulage costs as high as 50%.

Write for catalog and performance Bulletins.

THE FATE-ROOT-HEATH CO.
265 Riggs Ave., Plymouth, Ohio

PLYMOUTH
Gasoline Locomotives

Photo of tobacco dryer, courtesy of Proctor & Schwarz, Inc., Philadelphia, Pa.



Conveyor Belts
that have proved their economy

WICKWIRE Spencer Square Mesh Conveyor Belts are not on trial. Many years' use by leading manufacturers engaged in tobacco and wool drying has proved them the most economical. Their porosity allows free drainage of moisture and circulation of air and steam.

An excellent protection from rust and acid corrosion is provided by the heavy coating of *pure* zinc applied *after* weaving. By this method thorough galvanizing of every inch of wire is assured.

The long life of Wickwire Spencer Square Mesh Conveyor Belts results from the extreme care taken by the Wickwire Spencer Steel Company in each detail of their manufacture, from the mining of the ore to the finished article. More than a century's experience in making steel products is your guarantee of quality.

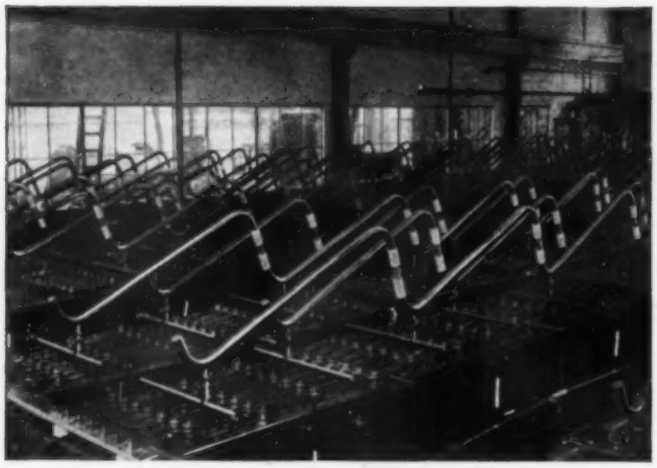
Write for price list and catalogue to:

WICKWIRE SPENCER STEEL COMPANY
General Offices:
41 East Forty-second Street, New York

Western Sales Office:
208 South LaSalle Street, Chicago

Worcester Buffalo Cleveland Detroit
San Francisco Los Angeles Seattle

WICKWIRE SPENCER PRODUCTS



Knowles Plant at Erith Oil Works, Kent England. 106 cells operating on 2,166 amperes at 2.25 volts per cell. Hydrogen capacity, 3,730 cu. ft. per hour.

HYDROGEN

Knowles Electrolytic Plants for high purity and low cost production

KNOWLES Patented Cells are safe, simple, easy to install and automatic in operation and very low in first cost with little if any maintenance expense. Cost of the Hydrogen will compare favorably with that from any system of Hydrogen production, but with the additional advantages of flexibility in operation, and the production of a quantity of pure oxygen equal to 50% of the Hydrogen volume.

Knowles Cells can be furnished in any size up to 12,500 amperes.

With 15 years' experience in the manufacture of electrolytic equipment and pure gases, we recommend the Knowles Cells unqualifiedly. Our Engineering Department is at your disposal for plans, layouts, estimates, and all information covering the production of Oxygen and Hydrogen.

Over 24 Knowles plants in operation with a total annual capacity of 1½ billion cu. ft. of Hydrogen. Installations include:

Societe des Engrais Azotés et Composés, Soulom, France.
70,000 cu. ft. of Hydrogen per hour. 10,000 kw.

Societe Italiana di Elettrochimica, Bussi, Italy.
14,000 cu. ft. of Hydrogen per hour. 2,000 kw.

Lever Bros., Ltd., Bromboro, England; Durban, S. Africa; Kobe, Japan; Sydney, Australia, and others.

Write for literature

American Manufacturers and Distributors

International Oxygen Company

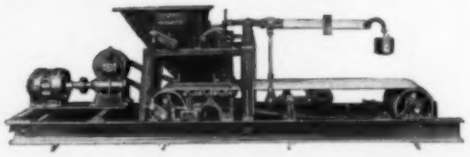
Pioneer American manufacturers of Oxygen and Oxygen Generating Apparatus

Also Producers of Hydrogen, Acetylene and Nitrogen

I.O.C. SYSTEM

Main Offices, Newark, N. J.
New York Pittsburgh Toledo

SCHAFFER POIDOMETER



ALMOST HUMAN

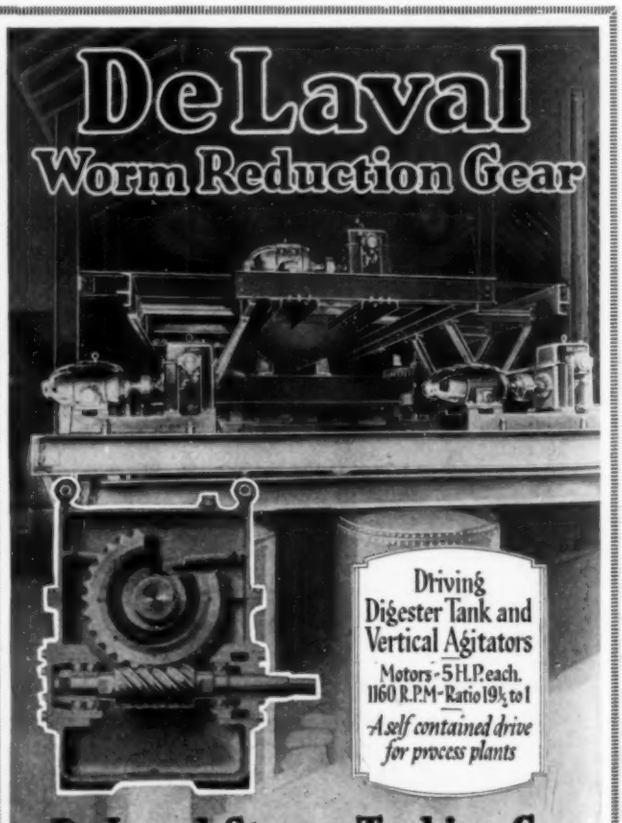
Schaffer Poidometers are the mechanical brains of the plant. They are more than that—they are guardians of the quality standards you have set for your product—they prevent waste and assure accuracy and maximum economy.

If you are handling a variety of materials, arrange your Poidometers in batteries—set one for each material and for the proportion wanted—then forget it! The Poidometer will do your bidding better than your most loyal employee. If any machine is not getting its full quota of material, the entire battery will automatically stop. Space does not permit of a thorough explanation of the many cost-saving qualities of Schaffer Poidometers.

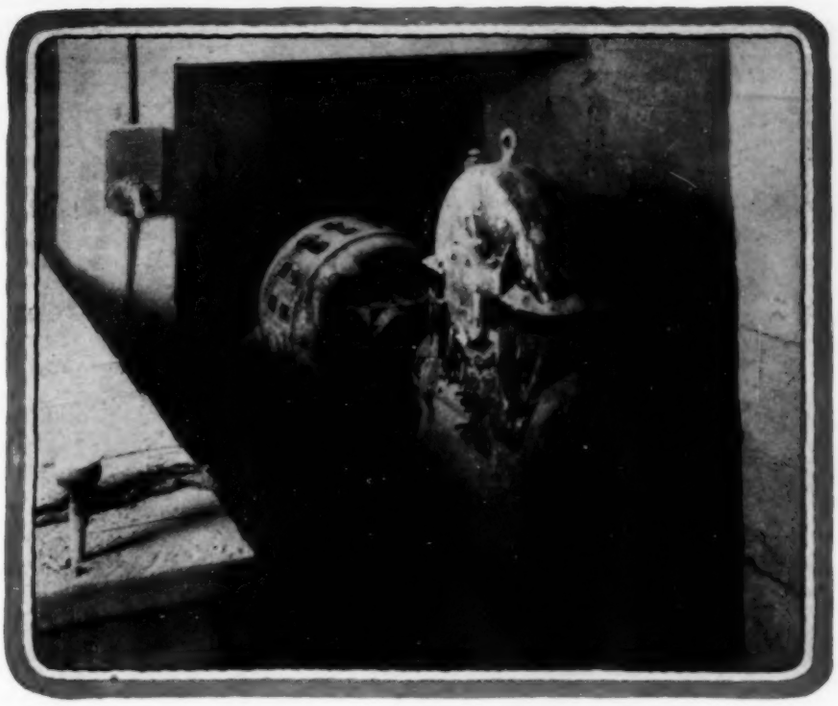
WRITE FOR FULL DETAILS.

SCHAFFER POIDOMETER CO.
2828 Smallman, Pittsburgh, Pa.

De Laval
Worm Reduction Gear



De Laval Steam Turbine Co.
Trenton, New Jersey



Forgotten . . . Covered with dirt . . . But faithfully doing its job with constant maintained efficiency

The Process Industries have hundreds of instances similar to this installation—where the equipment must stand up under severe working conditions.

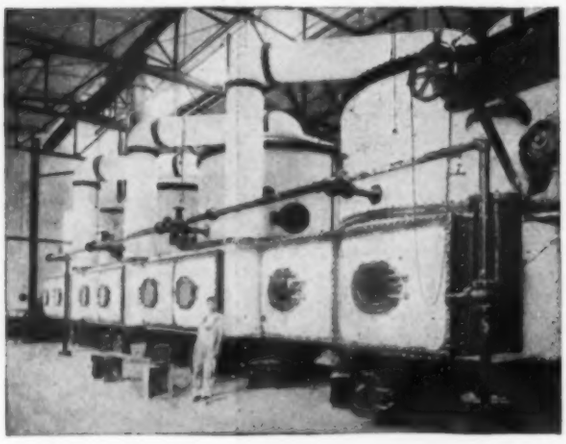
The all-enclosed feature of the Cleveland Worm Gear Reduction Units guarantees you dependable power transmission.

Cleveland Reduction Units can be run at four times the speed that was formerly thought safe for Worm drives—and continuously. We can point to instances where our Reduction Units have been giving 24-hour service for more than four years.

We have detailed performance data on Cleveland Industrial Drives as used in paper mills, rubber mills, power plants, cement mills and others. Our engineering department will gladly help you. Write to Department C.

CLEVELAND
WORM & GEAR COMPANY
CLEVELAND ~~ ~~~~ OHIO

BUILT FOR LONG LIFE — HARD SERVICE — NO WORRY TO THE OWNER



This is the largest quadruple effect evaporator for concentrating sulphite waste liquor of which we have knowledge. It has been giving satisfactory service with no worry to the owner since 1917.

Throughout the Process Industries-ZAREMBA

Horizontal Tube Evaporators	Vertical Tube Evaporators
Crystallizing Evaporators	High Speed Evaporators
Condensers and Preheaters	Hughes Foam Arresters
Leaching Batteries	Causticizing Apparatus
Automatic Feed Controllers	Soda Recovery Plants

Zaremba Company has specialized in the construction of evaporators since the beginning of its career. The excellence of its equipment is attested by the volume of repeat orders—over sixty per cent. Apparatus is built to specification only, with careful attention to governing conditions.

ZAREMBA COMPANY
168 Franklin St., Buffalo, U. S. A.
New York Office: 95 Liberty Street

ZAREMBA

Let us tell you

why so many large concerns find Buffalo Class "RDS" Boiler Feed Pumps the best for them.

There are real reasons for this growing popularity that you should know about. Write for Catalog No. 962—NOW.

Buffalo Steam Pump Company
501 Broadway, Buffalo, N. Y.
In Canada—Canadian Blower & Forge Co., Ltd. Kitchener, Ont.

"Buffalo" "RDS" pumps

PUMPS

For all requirements in the Chemical industrial field

Vacuum Pumps, Pumps for Mixing and Agitating, Filtration, Evaporation, Distilling, Drying, etc., etc.

Let us figure on your present needs.

A copy of our Vacuum Pump Bulletins will be sent on request

GUILD and GARRISON
Incorporated
Kent Ave. and So. 10th St., Brooklyn, N. Y., U. S. A.

THE high hydraulic efficiency of "American" pumps, their compact design and their sturdy construction all make for years of low cost performance. They are largely preferred by consulting engineers—whose discriminating opinion can be safely accepted as a criterion.

Branch Offices:

Chicago, Ill.	First National Bank Bldg.
Milwaukee, Wis.	Wisconsin National Bank Bldg.
New York, N. Y.	165 Broadway
Dallas, Texas	Western Indemnity Bldg.
San Francisco, Calif.	635 Mission St.

District Sales Agencies:

Philadelphia, Pa.	Kansas City, Mo.	Denver, Colo.
Pittsburgh, Pa.	Joplin, Mo.	Salt Lake City, Utah
Cleveland, Ohio.	Atlanta, Ga.	Phoenix, Ariz.
Detroit, Mich.	Birmingham, Ala.	Los Angeles, Calif.
St. Paul, Minn.	Jacksonville, Fla.	Charlotte, N. C.
Omaha, Nebr.	New Orleans, La.	Calgary, Alta., Can.
St. Louis, Mo.	Roswell, N. Mex.	

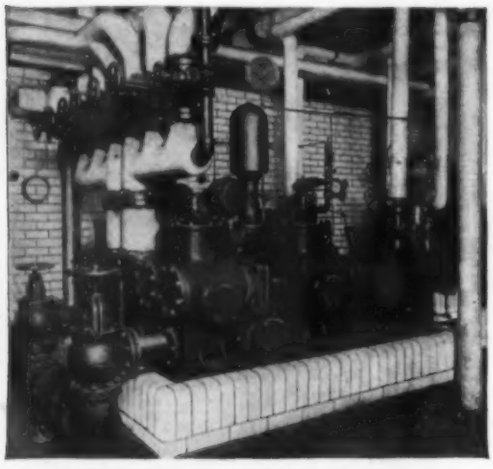
THE AMERICAN WELL WORKS

General Office and Works:
AURORA, ILL.

In service 13 years and still giving satisfaction

THE two Worthington duplex boiler-feed pumps shown were installed in the plant of the William Wrigley, Jr. Company, manufacturers of chewing gum, in 1913 and are still in service. Speaking of these pumps, William Robertson, chief engineer, says, "The cost of maintenance of these pumps has been very low and the general efficiency very satisfactory."

Other Worthington equipment in this plant, consists of two steam-driven vacuum pumps, a 1000 gal. per min. steam-driven fire pump and a motor-driven power pump for water service. All of the pumps mentioned have been in service for from 12 to 13 years.



Worthington steam-driven boiler-feed pumps installed in plant of William Wrigley, Jr. Company, manufacturers of chewing gum.

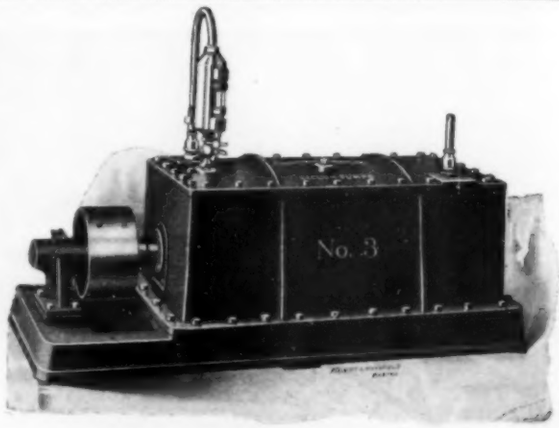
Long, satisfactory service with minimum upkeep are in-built characteristics of all Worthington products. Let us quote on your requirements. Each of the following represents complete lines:

Pumps—steam, power, centrifugal
Feed-water Heaters
Condensing Apparatus
Meters, water and oil
Compressors
Diesel engines
Gas engines

WORTHINGTON PUMP AND MACHINERY CORPORATION
115 BROADWAY, NEW YORK CITY BRANCH OFFICES IN 24 CITIES

WORTHINGTON

6131-2



Trimount Rotary High Vacuum Pumps

have for years given complete satisfaction in the X-Ray Tube, Incandescent Lamp Bulb, Vapor Lamp, Mercury Arc Rectifier, Thermos Bottle, Radio Tube, etc., industries. They are also used in General Laboratory work by Educational and Miscellaneous Industrial Research Departments.

These pumps are constructed for Pulley or Motor Drive. They are sturdily constructed, efficient and practically noiseless.

The No. 1 pump obtains a vacuum of 755 m.m. No. 1½—757 m.m. No. 2—759-970 m.m. No. 3—759-985 m.m. or better. Nos. 1, 1½ and 2 pumps obtain a still higher vacuum than above figures when used with a backing up pump.

Write for Catalog

TRIMOUNT ROTARY POWER CO.
300 Whiting Ave., East Dedham, Mass.
We also manufacture a line of Hand and Power Liquid Pumps

TABER-PUMPS

Send us your Pump Problems

STUFFING BOX CAPACITY
FOUR SHAFT DIAMETERS DEEP

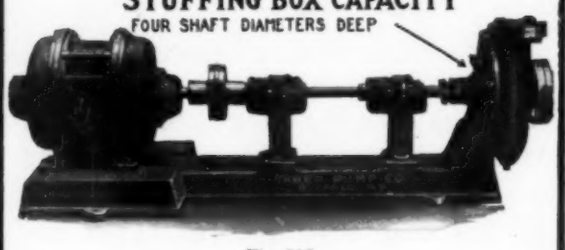


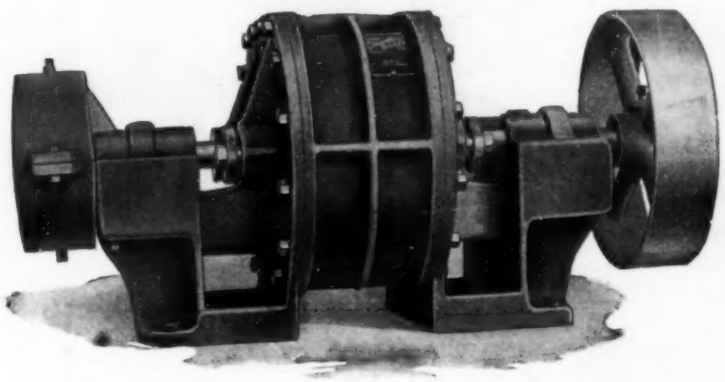
Fig. 603

The extra deep stuffing box, and external bearing supports, makes this pump particularly suited for the chemical industry. Extensively used for handling caustic liquors.

TABER PUMP COMPANY
BUFFALO, N.Y.

ROTARY POSITIVE GAS PUMPS

Processes where Uniform Pressure

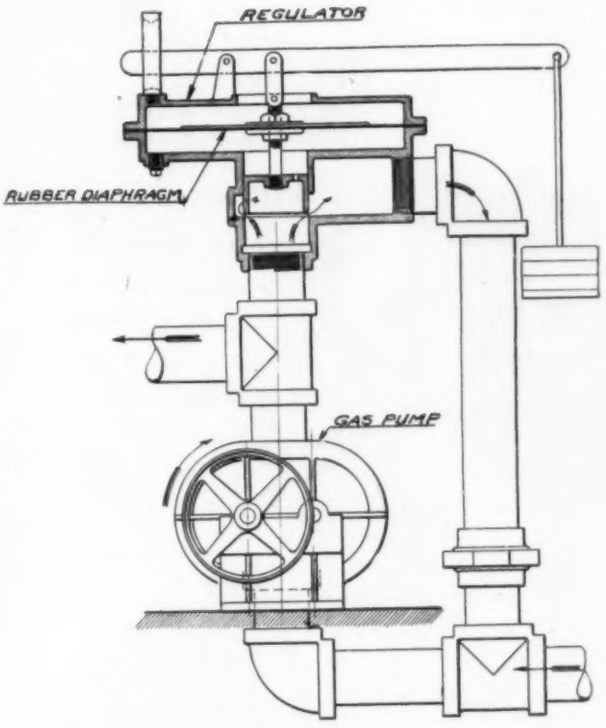


must be maintained although pressure in supply main may vary

SUCH applications occur frequently in a definite field covering certain Industrial installations, small Gas Plants, Oil Refineries, Explosive Works, Chemical Plants, etc., where uniform gas exhausting or boosting is demanded. A special Connersville Gas Pump is designed for the purpose.

This Pump always discharges an amount of gas slightly exceeding requirements, and the excess is returned to the suction side through by-pass, controlled by a Diaphragm Regulator (pressure or vacuum).

Practically any plant or process-condition throughout the Process Industries where air, gases or liquids are moved against medium pressures or suctions, can be satisfied by some member of the Connersville line of products. Our engineers always are glad to assist you.



Write for Bulletin 13C or for suitable literature covering any Gas Pump Application you have in mind.

The Connersville Blower Company
Columbia Ave. at 12th St.
Connersville, Indiana
53 W. Jackson Blvd. Chicago **114 Liberty St. New York**

CONNERSVILLE

Blowers • Gas Pumps • Meters • Cycloidal Pumps

For Accurate Knowledge of all Machine Speeds

PRACTICAL experience shows that this knowledge is invaluable to the Engineer, points the way to the success of the Maintenance Man and greatly simplifies Production problems. ¶Speed measurement may be read in any unit of speed or production. ¶Neither heat, cold, vibration nor length of service affects the accuracy of this speed indicator. ¶It is a highly refined magneto driven direct from the rotating part by a flexible shaft, pulley or gear. The magneto generates a voltage directly proportional to its driven speed and this voltage is transmitted by cable to a voltmeter speed indicator with its dial calibrated in speed units as desired. ¶Commercial experience and exhaustive laboratory tests show that this Tachometer is the most practical commercial speed indicator devised. It will solve your speed problems in a practical manner. ¶For complete information request Bulletin 3004.

WESTON

model 44 Speed Indicator

Exploded view showing the few parts

WESTON ELECTRICAL INSTRUMENT CORPORATION

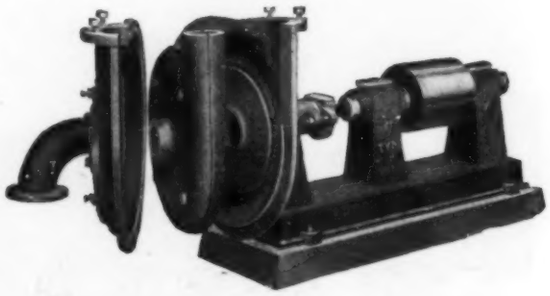
77 Weston Avenue, Newark, N. J.

STANDARD THE WORLD OVER

WESTON

Pioneers since 1888

for SLIMES or GRITTY WATER



This pump was built for handling slimes, sands and water containing gritty material. Glance at the photograph above showing a Krogh pump opened. Note the liners. You will see that a "Krogh" is entirely lined—on the inside!

These liners and the impellers are made ordinarily of a special, deep chilled car wheel iron. This means that they are very hard and tough — in fact, they must be ground to shape, because they are too hard for any tool steel to machine.

This is why you should use "Krogh" pumps where sand, gritty pulp and muddy solutions are handled.

Write for Bulletin giving details of the Krogh standard 2, 3, 4, 6 and 8 in. sizes.

Krogh Pump & Machinery Co.

147 Beale Street, San Francisco

Krogh SAND Pumps

A Good Compressor Investment

Every piece of equipment bought is an investment which brings in returns varying with its cost of operation, and productiveness. For the "long pull" invest in a

Sullivan Angle Compound Air Compressor

It will earn dividends from the day you start it up, and keep on earning them as long as your plant runs.

Angle Compound "earnings" include:

Smaller floor area.
Smaller foundations.
Less installation cost.
Lower H.P. consumed per 1000 cu. ft. of air compressed.
Economy of operator's time and labor.
Minimum repair cost.

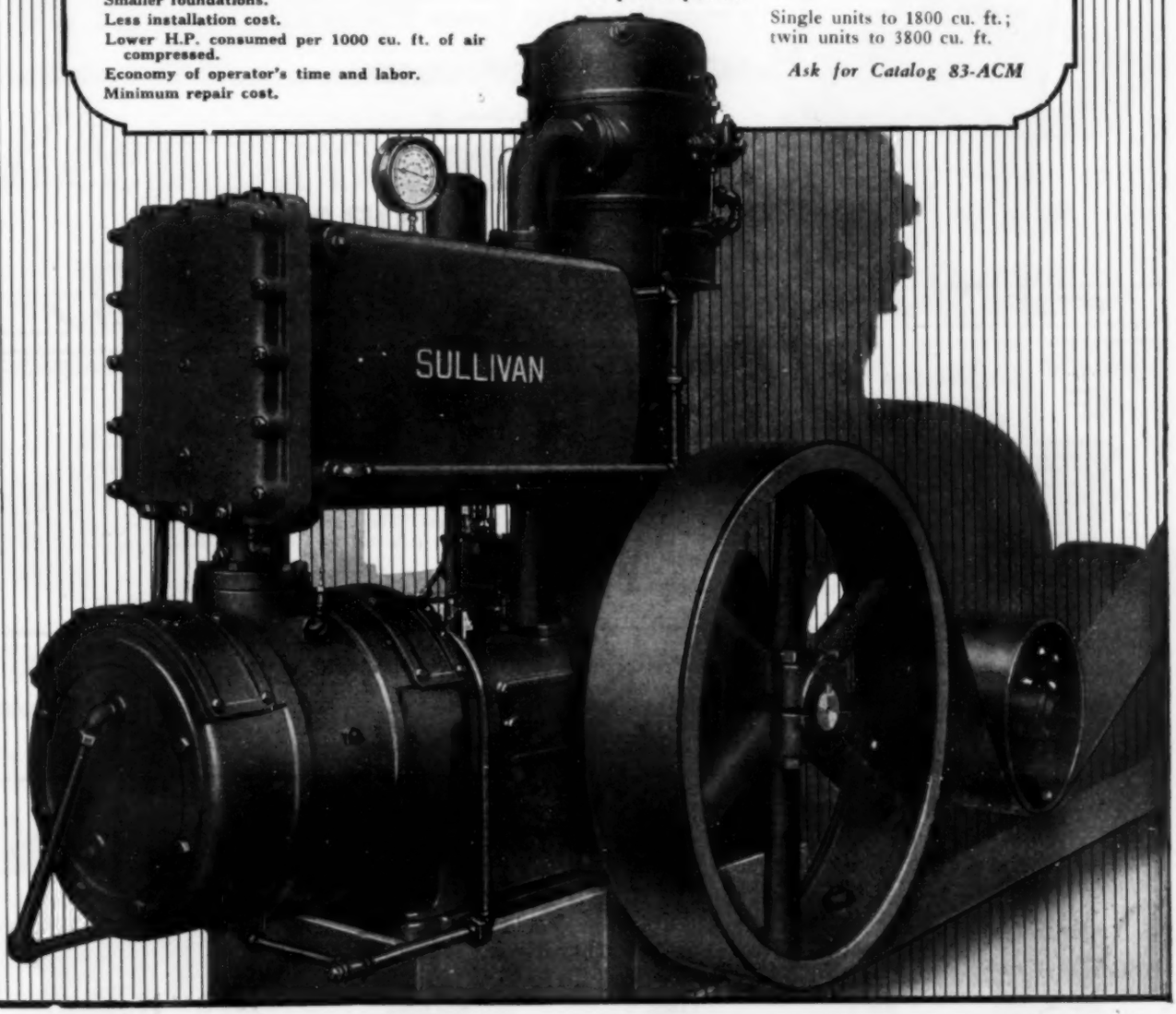
Hundreds of enterprises during the past 15 years have learned the value of an "Angle Compound" investment.

Sullivan Angle Compound balanced design enables these machines to run without perceptible vibration, hence smaller foundations and higher rotative speeds are permissible. Wafer air valves throughout, and three-pass counter-current copper intercoolers assure high volumetric efficiency.

The Sullivan automatic universal load and capacity control proportions the power used exactly to the work done. Smooth in action; no power peaks.

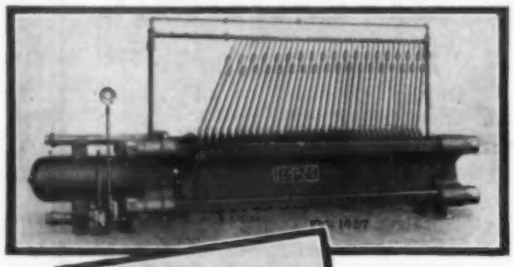
Single units to 1800 cu. ft.; twin units to 3800 cu. ft.

Ask for Catalog 83-ACM

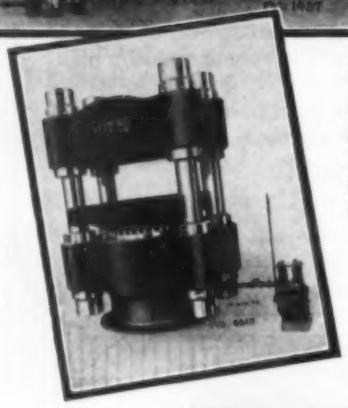


SULLIVAN MACHINERY COMPANY

MICHIGAN AVENUE AT ADAMS ST. **CHICAGO, ILLINOIS U.S.A.**



THERE'S AN H-P-M PRESS FOR EVERY HIGH PRESSURE JOB!



From Abrasive Wheels to Oleomargarine and a hundred products in between—there are standard H-P-M High Pressure Presses for their production.

H-P-M Presses are especially designed for specific applications. Thus they perform with greatest economy.

Perhaps your product could be handled by some such pressure operation as forming, molding, briquetting, extracting or separation. If so, inquire for the proper H-P-M High Pressure Hydraulic Equipment.

THE HYDRAULIC PRESS MFG. CO.

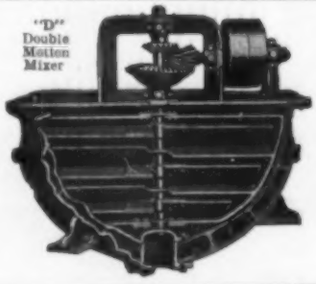
MOUNT GILEAD, OHIO.

H-P-M

HIGH PRESSURE HYDRAULIC

PUMPS PRESSES VALVES

"FOR YOUR PRESSING NEEDS"



"D" Double Motion Mixer

Proper Heat and Proper Agitation

In the complete line of DOPP apparatus there is a kettle of the proper size, and an agitator which will properly agitate almost any substance. If you have a mixing problem we will gladly co-operate and experiment to obtain the most efficient heat and agitation available.

DOPP *Seamless Jacketed* Equipment and Mixers.

Every DOPP kettle is *seamless* and leakless. There are no rivets to work loose or seams to open and leak. Every Standard kettle is tested to 150 pounds water pressure. We also build kettles for higher pressures.

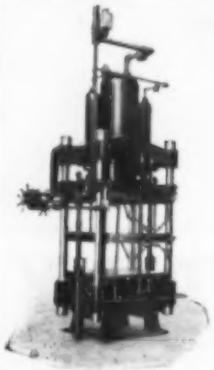
Write for your copy of Catalog No. 7.

Kettles: 1 to 1000 Gallons
Mixers: 16 Types

Vacuum and Pressure Apparatus 10 to 2,000 Gallons
Soap Crutchers: 1000 to 4500 lb.

SOWERS MANUFACTURING COMPANY
1302 Niagara St., Buffalo, N. Y.

ADOPT THE DOPP



Molded Battery—Box Press

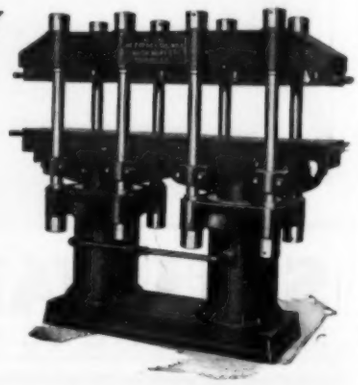
FRENCH HYDRAULIC MACHINERY

1900-1925

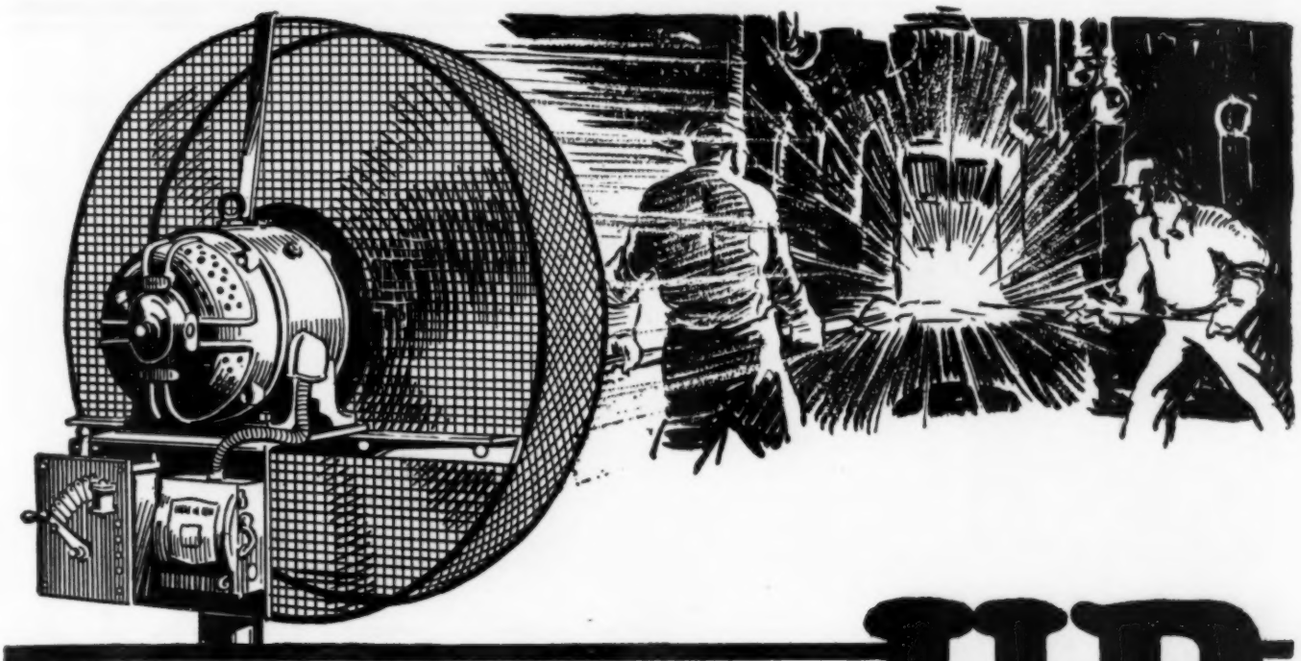
Presses, pumps, accumulators and all auxiliary control and operating equipment on complete installations and for all purposes. An experienced engineering service is for your benefit.

BALING	CURB	HOT MOLDING
BENDING	DRAWING	HUBBING
BRIQUETTING	DIE SINKING	LABORATORY
BROACHING	FLANGING	OIL SEED
BUSHING	FORCING	STRAIGHTENING
COLD MOLDING	FORMING	ETC.

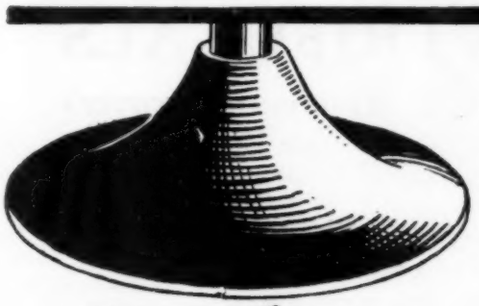
The French Oil Mill Machinery Co.
Piqua, Ohio



Hot Plate Vulcanizing Press



Keep production UP with man cooling fans



7 reasons why You Should Install *Man Cooling Fans*

1 Man Cooling Fans will cool the "hot spots" in your plant

2 —will keep men "on the job" regardless of summer heat

3 —will cut your labor turnover on jobs requiring high temperature treatment

4 —will cast a cool, refreshing breeze in any desired direction at any time

5 —will enable men to work on hot products with less delay

6 —will enable men to work longer shifts

7 —will speed up production and increase your profits

Every time you turn on the desk fan that makes your office a comfortable place in which to work, stop and think!

What are the men doing who are sweltering away on the hot jobs in your plant? What relief have they from stifling heat? Is the heat going to interfere with your production schedules? Will you have to hire more men to meet your shipping dates? Is your labor "turnover season" opening up? How much more efficient and contented would the men in your shop be with relief from the intense heat?

American Blower Man Cooling Fans are like giant desk fans. They provide cool, refreshing breeze on the "hot spots" in your plant. They will make your men contented, enable them to work longer shifts during terrific heat and make it possible for you to meet production schedules that would otherwise be out of the question.

Fortify your shop NOW against delays and losses caused by excessive heat by installing American Blower Man Cooling Fans.

AMERICAN BLOWER COMPANY, DETROIT, MICHIGAN
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

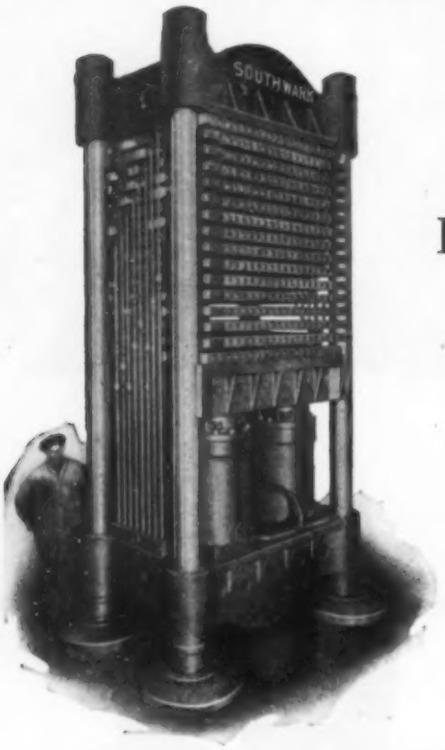
(521)

American Blower

"Sirocco" TRADE MARK

VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT

Manufacturers of all Types of Air-Handling Equipment — Since 1881



15-opening Multiple Cylinder Hydraulic Steam Platen Press, 800 Tons Capacity

If you have an operation on which hydraulic pressure can be used

SOUTHWARK

has the equipment to suit your requirements

Hydraulic Presses for Every Purpose

There is a Southwark Hydraulic Press designed to suit every moulding and vulcanizing requirement. Southwark Presses are used in the manufacture of Rubber, Fibre, Bakelite, Mica, Shellac and all other composite plastics.

The multiple cylinder steam platen press illustrated at the left is a late design and is typical of the large and complete line offered by Southwark.

If you have a special problem our Engineers will be glad to assist you in selecting a machine exactly suited to your purpose.

Our ninety years of experience is at your service.

Established 1836

SOUTHWARK

FOUNDRY AND MACHINE CO.

426 Washington Avenue

PHILADELPHIA, PA.

AMERICAN TOOL

WESTON CENTRIFUGALS

Original (1866)
Reliable
Economical

For All Chemicals Requiring Centrifugal Process

Automatic Sprayers for Washing Contents

Sizes 20-inch to 40-inch. Materials of construction adapted to product

Established 1843

AMERICAN TOOL & MACHINE COMPANY

Trade Mark Registered U. S. Patent Office

BOSTON

SUPERFINE DRY GROUND MATERIALS

can only be produced by using the

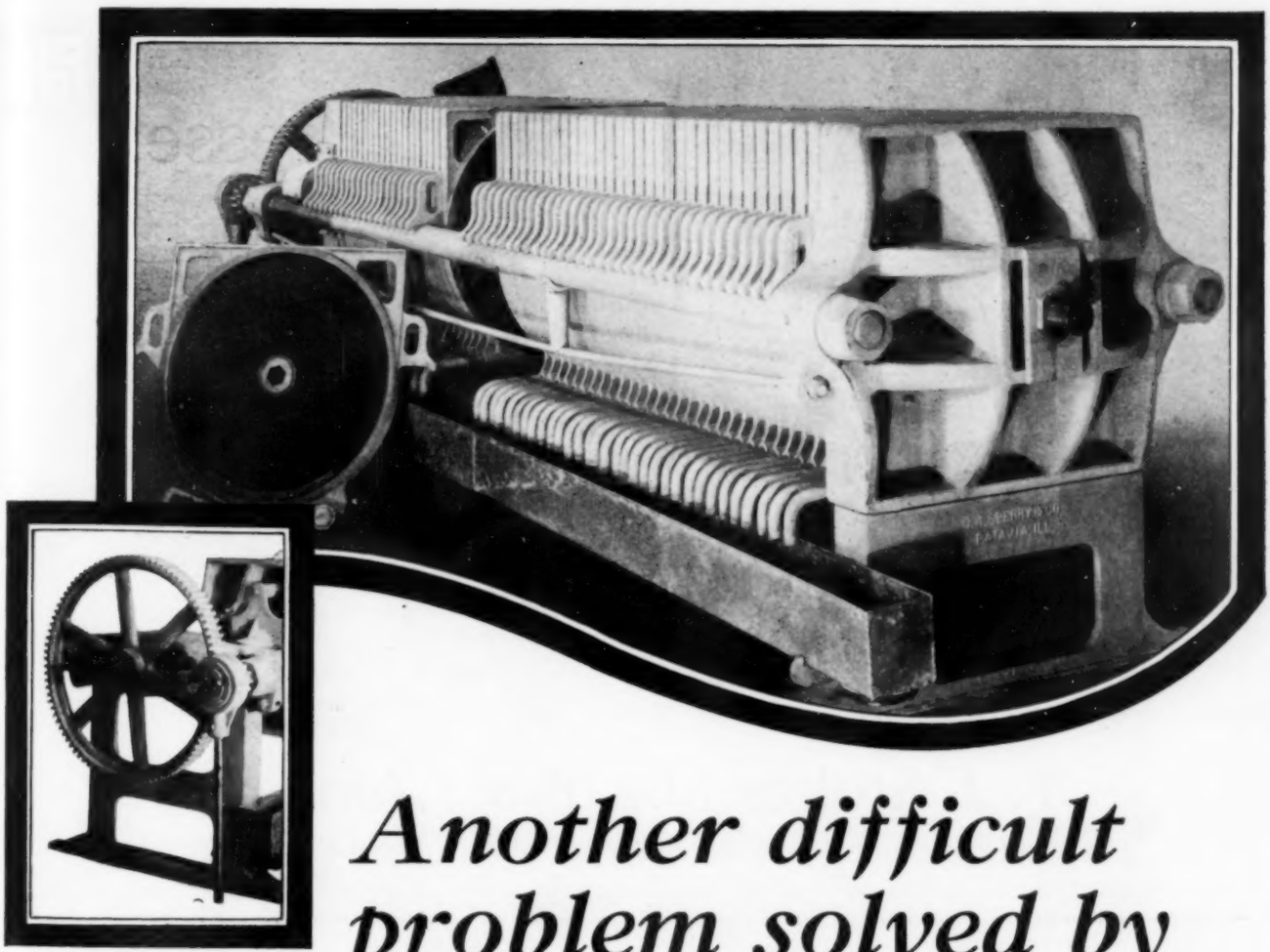
Gayco Dry Centrifugal Separator

Five years' successful operation has demonstrated the superiority of this wonderful machine over all methods of air and water separation.

It separates practically all fine dry materials, giving products from 80 to 350 mesh, as desired. Requires but little power to operate and costs almost nothing for upkeep.

Six Sizes From 30 Inches to 14 Feet in Diameter

Rubert M. Gay Company, Inc., 114 Liberty Street, New York, N. Y.



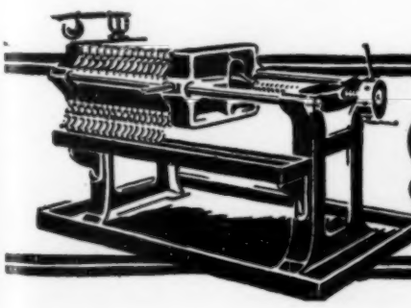
Another difficult problem solved by a Sperry Filter Press

Illustrations show both ends of 36-in. round plate, large flow high pressure press built for Illinois Watch Case Co., especially designed for recovering gold and silver from waste waters. Centerfeed, R. G. C. closing device, and 1-in. pipe outlets.

Typical of the way Sperry Filter Presses meet varied requirements, is the experience of the Illinois Watch Case Company, at Elgin, Illinois. They required a large, quick filtering, rapid flow, high pressure press for reclaiming gold and silver from waste waters. Besides the precipitating chemicals and the precious metals, the water contained grease, soap and benzine, and, in the customer's words, "there are few presses made that are really satisfactory for this work. The D. R. Sperry Company studied our needs with us and built a 50 plate 36-in. Press that has been entirely satisfactory in every detail during the six months of its operation."

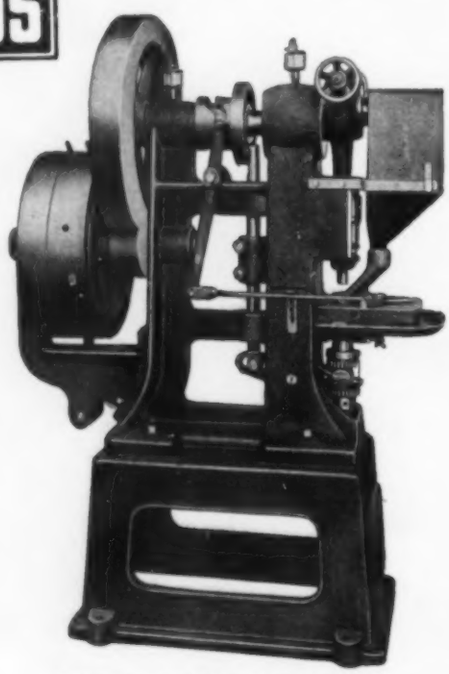
D. R. SPERRY & CO.
Batavia, Ill.

New York Agent: H. E. Jacoby, 95 Liberty St.
Pacific Coast Agents:
M. Pilhashy, Merchants Exchange Bldg., San Francisco, Cal.



SPERRY FILTER PRESSES

FJS



TYPE "T" TABLET MACHINE

FJS

STOKES

Tablet Presses

are making good

in the manufacture of these products:

Bakelite Preforms	Ink Tablets
Napthalene Balls	Carbon Brushes
Glass Insulator Beads	Mint Candy
Electrical Porcelain	Laundry Blue
Fertilizer Tablets	Grinding Wheels
Water Color Paints	Incense Cones

Metallic Motor Brushes

And, of course, the hundreds of varieties of medicinal and pharmaceutical products.

Tablet making methods have cut production costs in many lines.

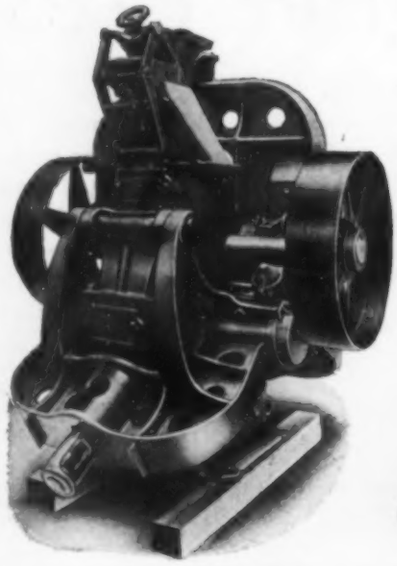
Can you use a Tablet Machine?

Free CONSULTING Service

F. J. Stokes Machine Company

5820 Tabor Road, Olney P. O., PHILADELPHIA

Maxecon Mill

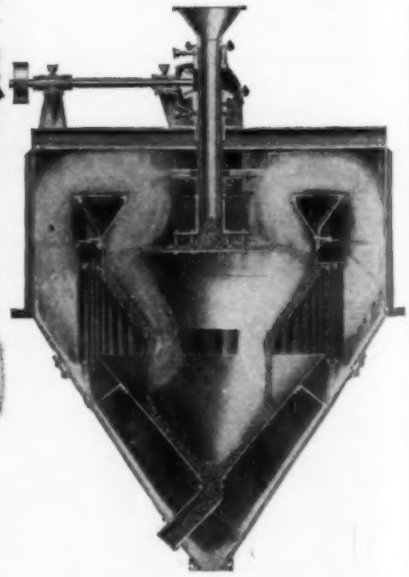


for economical pulverizing

Perfectecon Screen

for coarse screening

American Filter Air Separator



for fine separating

KENT MILL COMPANY

10 Rapelye Street Brooklyn N. Y.

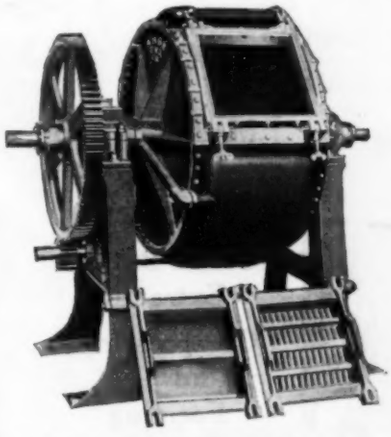
"The choice of those who have made comparisons"

ABBÉ
Pebble and Ball Mill

Chemical Reactions in the Process Industries are carried out at high efficiency in these specially designed mills.

We will supply them with Acid Resisting Linings, equipped for Vacuum or Pressure, and Jacketed for either heating or cooling.

The new Abbé Patented Discharge Valve saves much time in emptying, speeding up each cycle of operations.



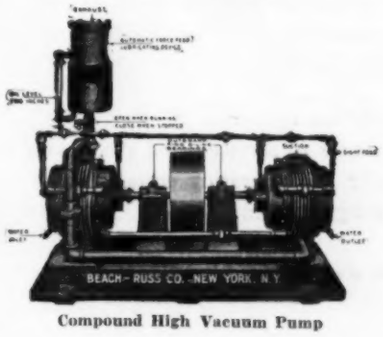
Abbé Ball Mill with Jacketed Cylinder and fitted with stuffing boxes

BEACH-RUSS
Vacuum Pumps

To meet the demand for constant high vacuum duty, we have developed the Type "R.C." Pump. Chief among its new features is the short "exposure" — to which are added heavier construction, special bearings and automatic oiling system.

For work involving the handling of corrosive gases these pumps are made of special metals.

Single Stage Guaranteed for 29½ in.
Two Stage Guaranteed for 29.9 in.
(Barometer being 30 in.)



Compound High Vacuum Pump

Let our Engineers help you on your problem

ABBÉ ENGINEERING CO. BEACH-RUSS COMPANY

34 Church St., New York

Telephone: Cortlandt 0054-55-56

BRANCHES: CHICAGO BOSTON PHILADELPHIA BALTIMORE LOS ANGELES

Canadian Representatives: Chemical Engineering Equipment Co.

ABBÉ Paul O.

PEBBLE MILL PARAGRAPHS

At Least 200 on hand —100 to 200 building!

What does that mean to you?

The mills you want, when you want them. No delays. No excuses. No valuable time lost in *your* plant or ours.

You can depend on this plant at Little Falls, N. J. For this plant has seen the birth of every outstanding improvement made on Pebble and Ball Mills during the last 13 years.

Check up the operation of Paul O. Mills—there are *thousands* in service—and you'll find records of low power and operating costs, reduced wear, and output ranging from 25% to 33-1/3% greater.

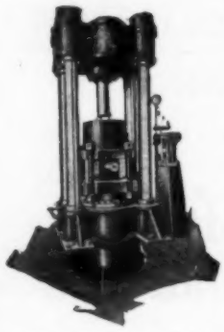
You can depend on "Pebble Mill Abbé"—and the whole trade knows it!

PAUL O. ABBÉ INC.

73-B Murray Street, New York City
Works at Little Falls, New Jersey

ABBÉ Paul O.

EXPERIENCE



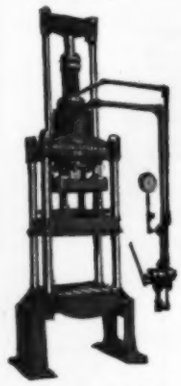
2100 Ton Lead Press
for covering cable and vulcanizing rubber hose.

Over 75 years of constant research has developed Watson-Stillman Hydraulic Machinery. This long experience insures you against experiments or untried designs.

We build complete hydraulic plants including pipe, valves, pumps, accumulators, intensifiers, and presses for every purpose such as:

Forcing
Dehydrating
Thermo Plastic Moulding
Blocking and Extruding
Briquetting
Baling
Clay Forming
Sagger Moulding

Heating and Chilling Press
for Rubber, Celluloid, etc.



Plastic Moulding Press
for Bakelite Redmanol condensite, etc.

Moulding and Vulcanizing
Oil Extracting
Cocoa Butter Extracting
Compressing and Forming
Etc.

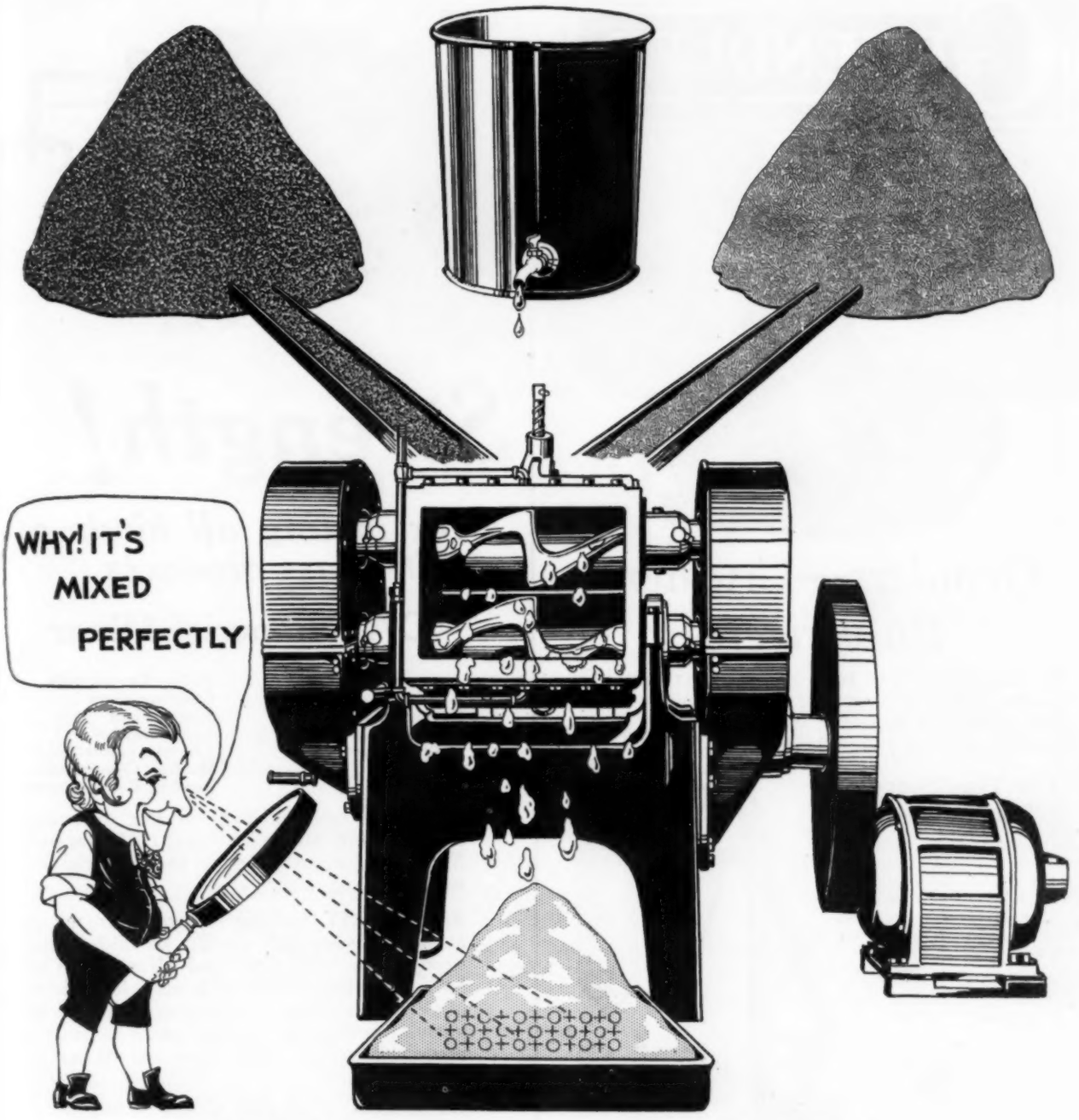
Curb Press
for Reclaiming Liquid Products.

Write for Bulletins.

The Watson-Stillman Company

74 West St., New York City

Chicago, 549 W. Washington Blvd.
Philadelphia, Widener Bldg.
Cleveland, Leader-News Bldg.
Detroit, 7752 DuBoise St.



OF COURSE IT IS! IT WAS DONE IN A

WERNER & PFLEIDERER UNIVERSAL MIXING & KNEADING MACHINE

BAKER-PERKINS COMPANY, Inc.

Werner & Pfleiderer Division

250 Park Ave.
NEW YORK

2004 Conway Bldg.
CHICAGO

901 Pacific Bldg.
SAN FRANCISO

Main Office and Works: SAGINAW, MICHIGAN

GRUENDLER

Especially adapted to the reduction of heavy chemical and fibrous materials. From 4 to 100 mesh. It's in a class by itself for general utility purposes.

Standard Whirl Beater

Grinders—Crushers Pulverizers

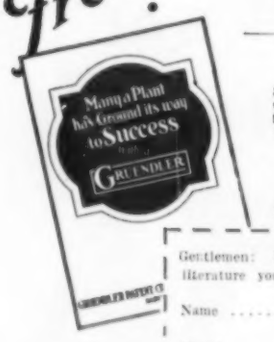
The experience gained from building more than 3000 grinders, handling everything from allspice to wood-paper pulp is the experience you buy when you specify Gruendlers in the process industries.

For Your Specific Requirements

In your particular industry there is a Gruendler especially adapted for your work. Send a sample of your product and fineness required, stating moisture content for capacities.

The only quick change pulverizer on the market. Adjustable beaters and heavy rollers, with air separation ranging in fineness from 80 to 300 mesh.

Free!



A Special Book

Shows the complete line, handsomely illustrated with full specifications and data, also special Bulletins for special fields. Fill out the coupon (there's no obligation) for a copy of this literature.

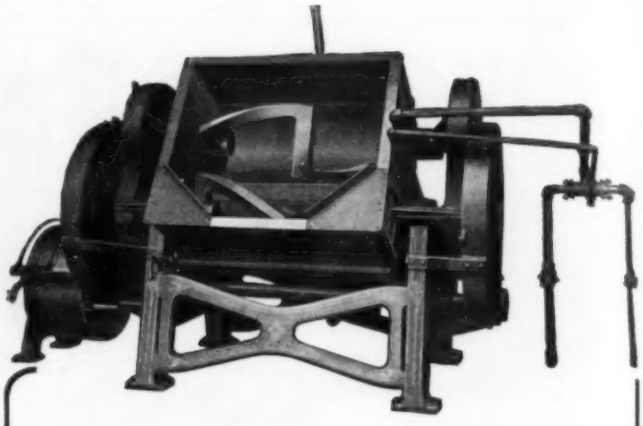
Gruendler Patent Crusher & Pulverizer Co.
907 North First St., St. Louis, U.S.A.

Gentlemen: Please send your latest catalog and any other literature you may have pertaining to our product.

Name .....

Street .....City .....

Product .....



Strength!

for mixing all kinds of stiff mass products

DAY Imperial Mixer

Asbestos Cements	**Boiler Compounds**
Analine Dyes	**Chewing Gum**
Battery Pastes	**White Lead**
Celluloid	**Carborundum**
Clay Products	**Electric Insulation**
Linoleum	**Rubber Compounds**
Putties	**Roofing Compositions**

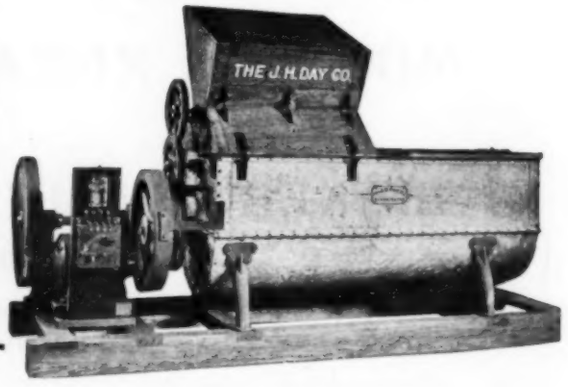
And many other products of like consistency are mixed with ease in the strong DAY Imperial. Made with steam jacket to keep material hot while being agitated.

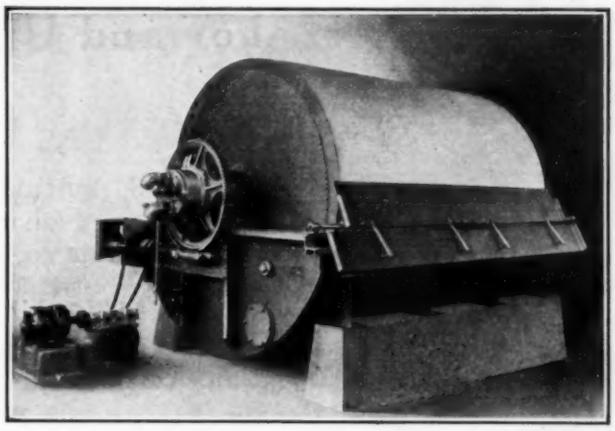
Another DAY machine designed for use in many industries and equally as efficient and strong is the DAY Sifter and Mixer shown below. This type of machine is made in a variety of sizes for many uses. Wherever a machine for mixing, aerating and sifting powdered goods is needed, there is a DAY Sifter and Mixer for the job.

Write for catalogue and plans for your installation.

THE J. H. DAY COMPANY
Cincinnati, Ohio

New York Boston Minneapolis Buffalo Philadelphia Kansas City Chicago Columbus Milwaukee Pittsburgh San Francisco St. Louis Dallas Los Angeles Atlanta





DEPENDABILITY

was claimed as a characteristic of

OLIVERS

in a recent advertisement.

An Oliver engineer after visiting a Western Flotation Concentrate Plant has this to report:

"The General Manager says he would like to order a new type Oliver but he can't wear out the old one."

The "old one" has been running continuously and successfully since 1914.

Another Concentrate Plant replaced their Olivers with filters of a supposedly superior make. Recently, after an extended trial, these were discarded and they again installed Olivers, because

Olivers Are Dependable

OLIVER FILTERS AND OLIVER-BORDEN THICKENERS

Oliver Continuous Filter Co.

San Francisco
503 Market Street

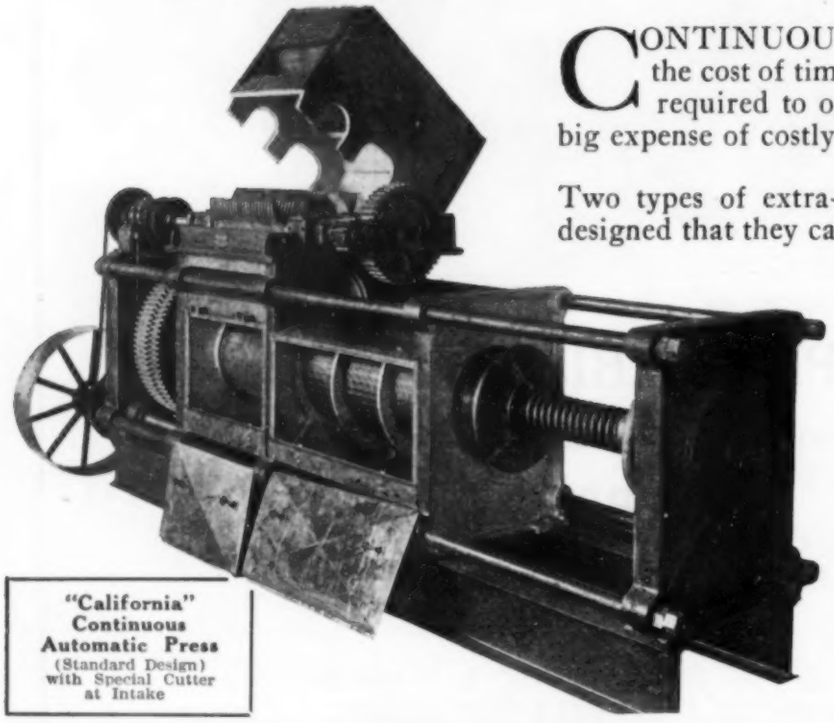
New York
33 West 42nd Street

London
11 Southampton Row

Johannesburg, South Africa, E. L. Bateman, The Corner House

"California" Continuous Automatic Presses

Bring down these Time, Labor and Up-Keep Costs:



"California" Continuous Automatic Press (Standard Design) with Special Cutter at Intake

CONTINUOUS, automatic operation reduces the cost of time and labor to a fraction of what is required to operate curb or cloth presses. The big expense of costly press-cloth is entirely eliminated.

Two types of extra-durable screens are provided, so designed that they cannot readily become obstructed by solids, yet giving a liquor or oil remarkably free from solid matter. These screens are built in sections, which are easily taken down and cleaned.

Learn all about the attractive economies afforded by these "CALIFORNIA" Standard Presses—successfully pressing Grapes, Lemons, Oranges, Pineapples, Distilling Waste, Boiled Pumpkin, Boiled Fish, and many other products.

California Press Mfg. Co.
1800-24 Folsom St.
San Francisco

Cement Chemists

like WHATMAN No. 31 for Silica.

Rapid enough for the busiest control laboratory yet strong and easily washed. Excellent for any large particle or gelatinous precipitate.

Let us send you a sample packet.

H. REEVE ANGEL & CO.
Incorporated
7-11 Spruce Street
New York, N. Y.

WHATMAN
High Grade FILTER PAPERS

FE INC FILTER DRYER FACTS

FACT No. 1
Continuous Filter + Cake Compressor — blow back — Scraper + String Discharge =
FE INC SCRAPERLESS FILTER
Handles thin and thick cakes alike.

for—
Paint Pigments
Lithopone
White Lead
Zinc Oxide
Iron Oxide
Whiting
Aluminum Hydrate
Silica
Chalk
Etc.—etc.

FILTRATION ENGINEERS INCORPORATED
SERVICE FE ECONOMY
253 BROADWAY NEW YORK

for—
Sugar Juices
Starch
Sewage
Dye House Waste
Decolorizing Carbons
Magnesia
Zinc Stearate
Calcium Sulphate
Lead Arsenate
Pottery Clays
Etc.—etc.

THIS BOOK May Help You Solve Your Filtration Problem Send for it—It's *FREE*

ANY manufacturer or producer who filters or clarifies any material will find information of vital interest in this Booklet. Our service department is always at your disposal to help solve your filtration problems, with the greatest economy. Send us your problem.

T. Shriver & Co.

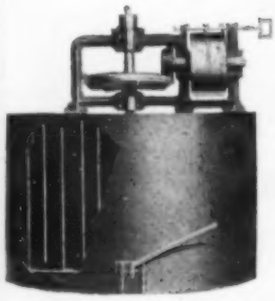
808 Hamilton Street Harrison, N. J.

The filter medium is just as important as the filter press. We sell specially woven filter cloths and filter paper at very close prices. We shall be glad to quote on your requirements.

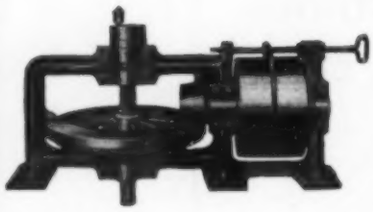
MIXING!!

Send for New 24 page Catalog ! !

Replete with illustrations and descriptions of agitating and mixing equipment.



Dye Processes
Sugar Refining
Glue Manufacturing
Paint Makers
Lacquer Manufacturers
Food Products
Oil Processing
Potteries
Soap Makers
Rubber Manufacturers
and many more.



The PATTERSON FOUNDRY & MACHINE COMPANY
RICHARD L. CAWOOD, PRESIDENT
EAST LIVERPOOL
OHIO, U.S.A.
Builders of Satisfactory Machinery since 1868
SATISFACTORY PATTERSON MACHINERY

FILTERS
for Clarifying
Medicines—Oils—Perfumes—etc.

CLOUDY liquids, full of sediment, are transformed into beautifully clear, sparkling, products by means of Kiefer Filters in thousands of plants.

We make—

Filtermasse Filters **Paper Sheet Filters**
Cloth Filters
20 Types and Sizes

Send a gallon of your product to us and we will show you what can be accomplished by a Kiefer Filter

THE KARL KIEFER MACHINE CO.
Cincinnati, Ohio

LIGHTNIN PORTABLE MIXERS

Clamp on any Tank open or closed

ARE FAMOUS the WORLD OVER

Their far-reaching success is the reward of dependable structure and superior mixing.

Telescopic Shaft Adjusts to any angle

The Original Electric Portable Mixers

A size and speed for every need

Investigate—it pays

We specialize in fluid mixing machinery, any capacity.

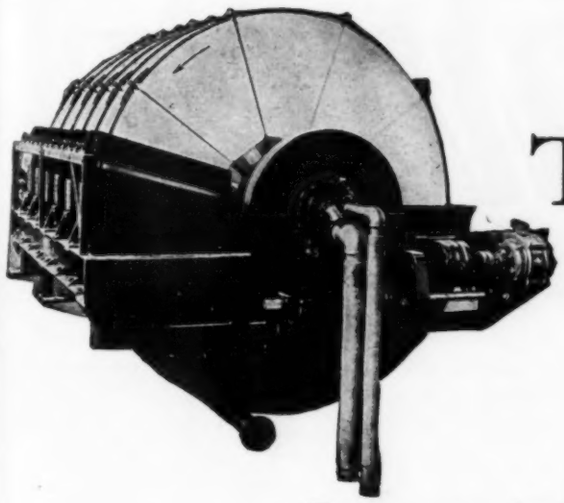
Propellers any Combination

PATENTS PENDING

Many sizes, 1/20, 1/4, 1/3, 1/2 and 1 H. P. Vertical Motors. Various speeds, direct drive and geared models.

Write for New Catalog 22

MIXING EQUIPMENT CO., Inc.
229 East 38th St., NEW YORK, N. Y.



Why Call It The American *Continuous* Filter?

Because it is

Continuous **in operation**

Continuous **in efficiency**

Continuous **in satisfaction**

Continuous **in economy**

Thousands of American Continuous Filter Users Will Tell You

"Well Named"

Continuous in Increased Sales, Too.

The performance of a product influences its increased sales—that is why we feel it will interest you to know that 28,300 square feet of filter area was supplied to various industries in 1925—while the first two months of 1926 saw 6,666 square feet leave our factory for different industries.

You can always get information on this filter from any one of our offices.

Sweetland and Kelly Pressure Filters
American Continuous Filters

UNITED
AMERICAN SWEETLAND KELLY
FILTERS

United Filter Presses
Sweetland Thickeners

UNITED FILTERS CORPORATION

Main Office: Hazleton, Pennsylvania

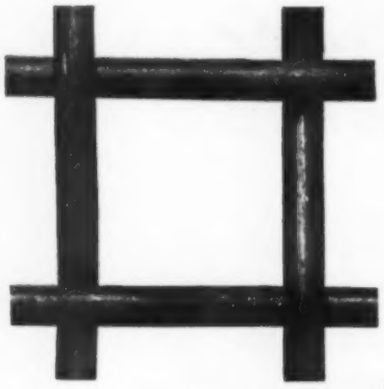
New York Los Angeles Chicago Salt Lake City

Export Office—25 Broadway, New York City Code Address—Unifilter, New York

Buffalo WIRE

"A BETTER WIRE CLOTH"

—as heavy or fine as you want it

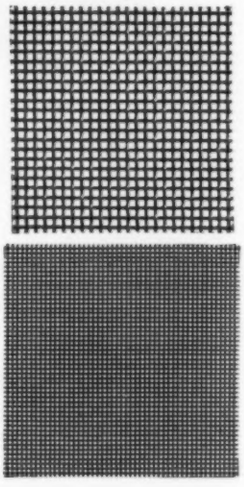


From 1-inch space down to 300 mesh brass every piece of "Buffalo" wire cloth is the highest quality obtainable.

THE "Buffalo" line includes all wire products—wire cloth in square or oblong mesh, a wide range of widths and weights. To meet special needs we can furnish cloth woven from German silver, nickel, Monel metal, monnot copper, silver, phosphor bronze, aluminum, lead, or charcoal iron. More than half a century in the making of wire products is your assurance that "Buffalo" quality and service are 100 percent dependable.

Send for Catalog No. 8 GG

BUFFALO WIRE WORKS CO., Inc.
(Formerly SCHEELER'S SONS, Est. 1869)
482 Terrace, Buffalo, N. Y.



GAS HOLDERS

and

Gas Plant Equipment

for

Chemical and Metallurgical Plants

STACEY BROS.
GAS CONSTRUCTION CO.
Station P
CINCINNATI, OHIO
New York Office: 350 Madison Ave.
Room 1019

Perforated Metals and Mining Screens of All Kinds

Any size or style holes, any thickness of metal, flat or rolled, to fit your equipment.

Tell us of your requirements

Prompt shipment

Chicago Perforating Co.
2439 West 24th Place
CHICAGO, ILL.
Tel. Canal 1459

1/2—the Satisfaction

in using Wire Cloth

is getting

it when

You need it!

Emergency calls are *gravy* to us.

Prompt shipment, our middle name. Our large complete stock and our quick delivery system insure your getting the goods in the shortest possible time. Hurry-up orders are given immediate and personal attention.

Add to this speedy delivery service, the ability (because of our broad experience in all industries) to make helpful recommendations about the problems peculiar to your plant and process—and you begin to understand why the leaders prefer Multi-Metal.

For Wire Cloth, wire Multi.

MULTI METAL CO.

WIRE CLOTH FOR MECHANICAL SEPARATION
FILTRATION - EVAPORATION - DRYING

804 EAST 139TH STREET, NEW YORK CITY

Perrin Filter Presses — Plates — Frames

Filter Presses for all filtration and separation operations using Plates or Plates and Frames of metal or wood.

Perrin Presses may be furnished with hand or power closing mechanisms.

Recessed Plate | Cake Frame | Flat Plate

Iron Recessed Plate Press

We have patterns for all sizes of recessed Plates in either square or round types, also for flat Plates and extension cake Frames, on which handles can be altered, if necessary, to suit other Presses.

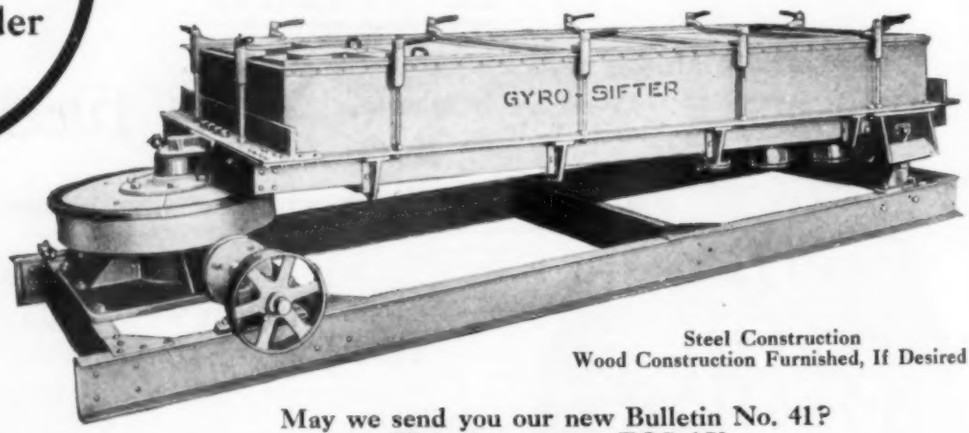
We can make up all sizes of wood flat Plates and wood extension cake Frames according to the specifications received.

WILLIAM R. PERRIN & COMPANY
36 W. Van Buren St., Chicago, Illinois

The
GYRO-SIFTER
Is Made To Order FOR YOU

Of course, GYRO-SIFTERS are made in a multitude of standard styles and sizes, yet each machine you install is "individualized" for successful operation on YOUR particular product. This is accomplished through proper installation of the machine for convenient charging—through scientific arrangement of the sieves for making separations to conform with results of laboratory tests—and through providing outlets to admit of uninterrupted discharge of products to any points of the plant desired.

This engineering service forms a part of GYRO-SIFTERS. We shall be pleased to cooperate with you in securing the results you desire. No matter what your product is, if it is "siftable" the installation of GYRO-SIFTERS will prove a revelation in efficient production and economical operation.



Steel Construction
Wood Construction Furnished, If Desired

May we send you our new Bulletin No. 41?
Write for a copy—TODAY

UNIQUE

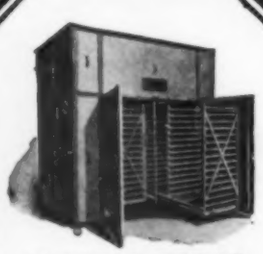
ROBINSON MFG. CO.

PAINTER STREET, MUNCY, PA.
MANUFACTURERS OF PROCESS EQUIPMENT
Crushers, Grinders, Pulverizers, Sifters, Mixers, Elevators and Conveyors

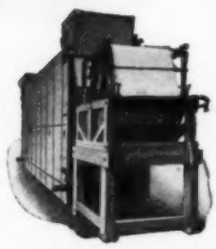
UNIQUE

DRYING MACHINERY

For all materials *For any size output*



PROCTOR TRUCK DRYER for Chemical Products, Ceramics, Rayon, etc.



FEinc DRYING SYSTEM (Filtering and drying in one continuous process.)

PROCTOR & SCHWARTZ, INC.
PHILADELPHIA.

Our business is Getting Your Wires Crossed

This is where we do it

Our new factory on Verona Ave., Newark, N. J.

Crossing wires ACCURATELY is our specialty.

The wire cloth business was pioneered by us. Having made more of it than anybody else we naturally KNOW HOW better than anyone else. Take for example.

"NEWARK" Metallic Filter Cloth

which is known and used the world over and which was developed by us. It has a double surface, is wonderfully strong, and unusually durable. It is generally made of Monel Metal.

Newark wire cloth is made of all malleable metals: aluminum, brass, copper, bronze, tinned metals, nickel-chromium, steel, gold, silver, monel metal, platinum, and special alloys. Therefore, whatever your filtering or sifting problem, you can be pretty sure that we have a wire cloth in stock of the right metal, space, diameter, length, and width that will handle it.

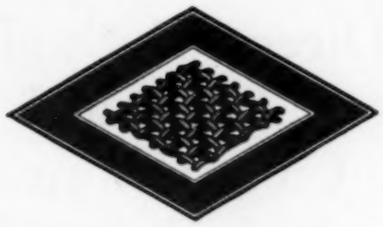
If you haven't our new catalog No. 25, be sure to ask for a copy.

Newark Wire Cloth Co.

Double Crimp

350-364 Verona Ave.
Newark, N. J.

Branch Office:
66 Hamilton St,
Cambridge, Mass.



Put a Crimp in your losses!

Your loss of money through inferior Screen or Filter Cloth is often more serious than you imagine.

Just figure out the almost countless delays, with their effect on production; the waste of labor and material—with their resulting expense. Figure it out for a year!

Nor does this take into account the danger to the quality of your product.

You will see that inferior-quality wire cloth doesn't pay, despite its *cheapness*.

"Cleveland" Double Crimped Wire Cloth will put a crimp in those losses! "Cleveland" is made in all styles, weaves, metals—but just one quality—the highest!

Send for Catalog No. 2 containing new items and Price Lists.

The Cleveland Wire Cloth & Mfg. Co.
3574 East 78th Street,
CLEVELAND, OHIO

All styles, weaves, sizes and metals.

2x2 mesh—.192 Wire

Centrifugal Cloth

Cleveland Wire Cloth

with the Double Crimp

Direct Methods of Chemical Calculations in Industry

This is the first volume in our new Chemical Engineering Series. It is a book of direct methods of calculation in the chemical processes of industry. You will find it a helpful tool in every calculation you are called upon to make. We invite you to examine it for 10 days free.

The first volume in our new Chemical Engineering Series

Industrial Stoichiometry

Chemical Calculations of Manufacturing Processes

By **WARREN K. LEWIS**
Head, Department of Chemical Engineering, Massachusetts Institute of Technology
and **ARTHUR H. RADASCH**
Professor of Ceramic Engineering, N. Y. State School of Ceramics
174 pages, 6x9, $2.50
CHEMICAL ENGINEERING SERIES

Examine it for 10 days free

This new book is an aid in the technique of computation for all those interested in the chemical phases of industry.

The book is intended as a tool for the chemical engineer, whether he is interested in present performance or design of equipment.

It shows how the performance of a process can be easily determined without the use of expensive equipment or interference with production.

Just Out!

The book gives special attention to

—continuous and semi-continuous processes;
—the measurement of quantities, industrially important and yet not subject to direct measurement or measurable only at disproportionate expense;
—the technique of cross-checking industrial chemical data.

See it free

May we send you your copy of this new book for 10 days' free examination? We believe you will want to add it to your working equipment.

McGRAW-HILL
FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York.

You may send me on 10 days' approval **Lewis and Radasch—Industrial Stoichiometry, $2.50 net, postpaid.** I agree to remit for the book or return it postpaid within 10 days of receipt.

.....I am a regular subscriber to Chem. & Met. Engineering.

Signed .....

Address .....

Official Position .....

Name of Company .....

(Books sent on approval to retail purchasers in the U. S. and Canada only.) M. 6-1-26

TANKS
Wood or Steel

Cypress	Round, Square
Redwood	Riveted
Cedar	or
Fir	Welded

All sizes, shapes and kinds

Agitator Drives
Double Headed
Rubber Lined
Lead Lined
Pressure

The General Tank Corp.

Sales Office	*Plant*
30 Church St.	12-16 Monitor St.
New York	Brooklyn

"Bags of all Kinds"

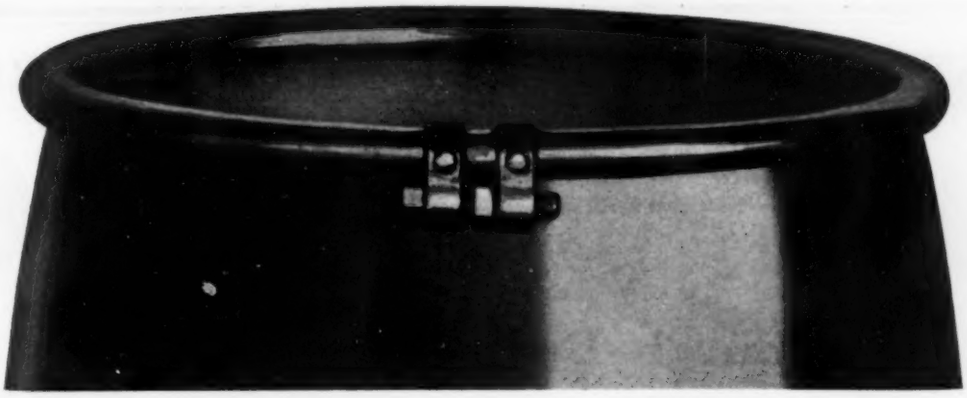
"Chase"

Special Bags for special purposes, made from Burlap, Cotton or Paper or combinations thereof—Let us have your problems.

CHASE BAG CO.

Buffalo, Memphis, New Orleans, Cleveland, Milwaukee, St. Louis, Kansas City, Minneapolis, Toledo

ESTABLISHED 1847



See This Seamless Construction— It Makes Cleaning Easy

Notice the smooth even surface of this Hackney Removable Head Barrel. The entire body is pressed from a single sheet of open hearth steel—and bilged to shape. There is not a seam or crevice in it to accumulate residue. This makes the Hackney easy to clean and keep clean.

Such seamless construction gives this barrel the strength and rigidity that defies rough usage. There are no seams to rust or spread—and the bilged shape makes even denting practically impossible.

And the patented head construction makes this Hackney absolutely liquid tight. The barrel edge is curled *outwardly*. The head fits over this curl and clamps beneath it. A heavy steel hoop—drawn up by one bolt—keeps the head in place. And a gasket completes the job of locking out all chance for leakage.

For more detailed description on how Hackney Removable Head Steel Barrels save you time in cleaning—reduce spoiled shipments and practically eliminate leakage, write to—

This is only one of the many Hackney products. There are Seamless Bilged Barrels—Two-Piece Barrels—Drums for both heavy and light shipping—Seamless Shells and Containers—and shells of special shape. Remember that there is a Hackney to fill practically any drum or barrel need.

THE PRESSED STEEL TANK COMPANY

1149 Continental Bank Bldg., Chicago
1325 Vanderbilt Concourse Bldg., New York
5709 Greenfield Avenue, Milwaukee

Hackney
MILWAUKEE

STEEL TANKS AND PLATE WORK

Pittsburgh-Des Moines steel tanks, ranging from 250 gallons to 80,000 barrels, provide storage for water, oil, acid, alcohol and other liquids used in the chemical industries.

Write to our nearest office for estimates of what you need. For over thirty years we have specialized in this line of work; our engineers will be glad to discuss your plans, giving you the benefit of our long and varied experience.

Send for Oil Tank Booklet No. 48
or our Elevated Tank Booklet No. 48.

Pittsburgh-Des Moines Steel Co.

950 Curry Bldg., Pittsburgh, Pa. — 654 Hudson Ter'l Bldg., N. Y. City

Des Moines · Dallas · Chicago · Seattle · San Francisco · Atlanta

Lead Burning Contract Work

both light and heavy

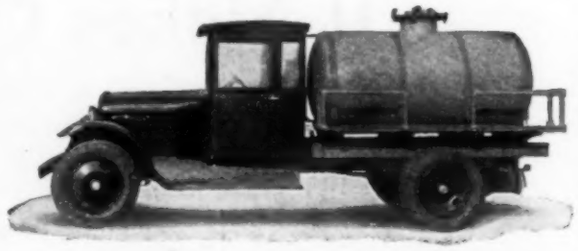
for the following industries:

Chemical	Rayon
Explosives	Textile
By-Product Coke	Oil Refining
Coal Tar Products	Smelting
Rubber	Gas
Fertilizer	Soap
Dyestuffs	Electrochemical
Pulp and Paper	Cellulose

In addition to the above we specialize in homogeneous lead coatings on all kinds of equipment subjected to *high heat, pressure* or *vacuum.* We own the Gross formula (torch method) which gives longest life and lowest upkeep to equipment so treated.

Send for descriptive circular.

GROSS LEAD BURNING & COATING CORP.
Office and Factory: W. 73rd St. and Clinton Rd., Cleveland, O.



Haul Your Liquid Chemicals This Way

Transportation Tanks lined with Acid Resisting Green Glascote eliminate shrinkage of contents, breakage of containers, and all undesirable reactions. They speed up deliveries and save labor at both ends of the haul. Glascote resists all commercial acids excepting hydrofluoric and hot phosphoric, and their salts. Tanks made in all capacities up to 5,000 gallons, for trucks, trailers.

Send for Bulletin.

THE GLASCOTE COMPANY
EUCLID, OHIO (Cleveland District)
New York Office, 15 Park Row
St. Louis Office, 905 Carleton Bldg. Detroit Office, 1217 Book Bldg.

GLASCOTE

Atlantic Tank & Barrel Corp'n

Wooden Tanks of all descriptions

Tight cooperage Red and White Oak

Tonnele Ave. & Hamblet Place
North Bergen, N. J.

American

for testing dielectric strength of insulating oils before shipment

This transformer, complete with potentiometer regulator, primary main line switch, voltmeter, circuit breaker, pilot lamp and oil testing cup, is mounted in a heavy oak case with angle iron protecting pieces on the corners.

To Refineries and Oil Supply Houses

Users of insulating oils are demanding a product that meets certain specifications regarding dielectric strength.

The American Transformer Company's TS-6 oil testing set will enable you to test oil samples quickly and conveniently. This affords ample proof of the quality of the oil supplied.

Every refinery and oil supply house should protect themselves and their customers by checking up the dielectric quality of oil before shipping.

The complete equipment can be loaded on a truck or flivver and transported to the field, laboratory tanks, store house, dealers warehouse or wherever the insulating oil is to be tested.

Our new bulletin 1025, which has just been published, fully describes this unit together with many other types of testing apparatus of all kinds. *Copies sent on request.*

AMERICAN TRANSFORMER CO.
182 Emmett St., NEWARK, N. J.

Transformers

Lead and Lead Line Equipment

Chemical Lead Burning

Acid Chambers and Towers, Lead Lined Tanks, Lead Linings for Tanks, Vats, etc. Lead, Condensing, Cooling and Heating Coils, Lead Sleeves, Agitators, Lead and Lead Lined Pipe and Fittings.

Pure Tin Linings and Coil for vessels of every character.

SPECIALISTS in Chemical Lead Burning, experienced in design of Chemical Equipment made of lead, and made to meet your specifications and requirements.

Our products cover practically everything in the chemical line where lead is used.

JOHN F. ABERNETHY & CO., INC.
708-710 Myrtle Ave., Brooklyn, N. Y.
Established 1901

CHIMNEYS for INDUSTRIES Using CHEMICAL PROCESSES

Acid Proof Chimneys

Handling

Acid Gases

For Smelters, Chemical Works, Paint Works, By-Product Coke Ovens. ALSO for BOILERS, Ovens and Furnaces. All Sizes.

Built of Impervious Radial Brick

BOILER SETTINGS— REFRACTORY BRICK WORK

ALPHONS CUSTODIS CHIMNEY CONS. CO.
95 Nassau St., New York
Marquette Bldg., Chicago

Send for Free Booklet CM7 "Construction and Design of Chimneys Subjected to Acid Gases."

Money out of Waste!

COTTRELL PROCESS of Electrical Precipitation

Calder-Fox Scrubbers

Reineke Regulations

The Cottrell Process not only raises the efficiency of operation by removing dust and fumes from the smoke and air of your plant, but also salvages particles of value.

Operation is simple, and the installation of equipment soon pays for itself.

For Cement Mills the new type of Graded Resistance Electrode construction offers the advantages of the Process at still lower cost.

Calder Fox Scrubbers are the most modern device for sulphuric acid mist collection. Reineke Regulators are standard for the quick, accurate regulation of gas flow.

Western PRECIPITATION CO.

Los Angeles, Calif.
Eastern Office: 25 W. 43rd St., New York City

SOLVENT RECOVERY

Heat exchanger

Artificial leather
Artificial silk
Bakelite paper
Automobile lacquering
Photographic films
Celluloid
Rubber goods
Explosives
Natural gasoline
Benzol

are but a few of the numerous industries where the

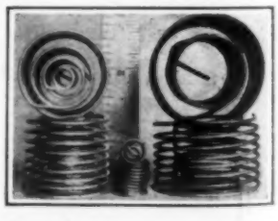
Bregeat Solvent Recovery Process

will pay for itself in a short time.
We design and install complete equipment for conducting the process.

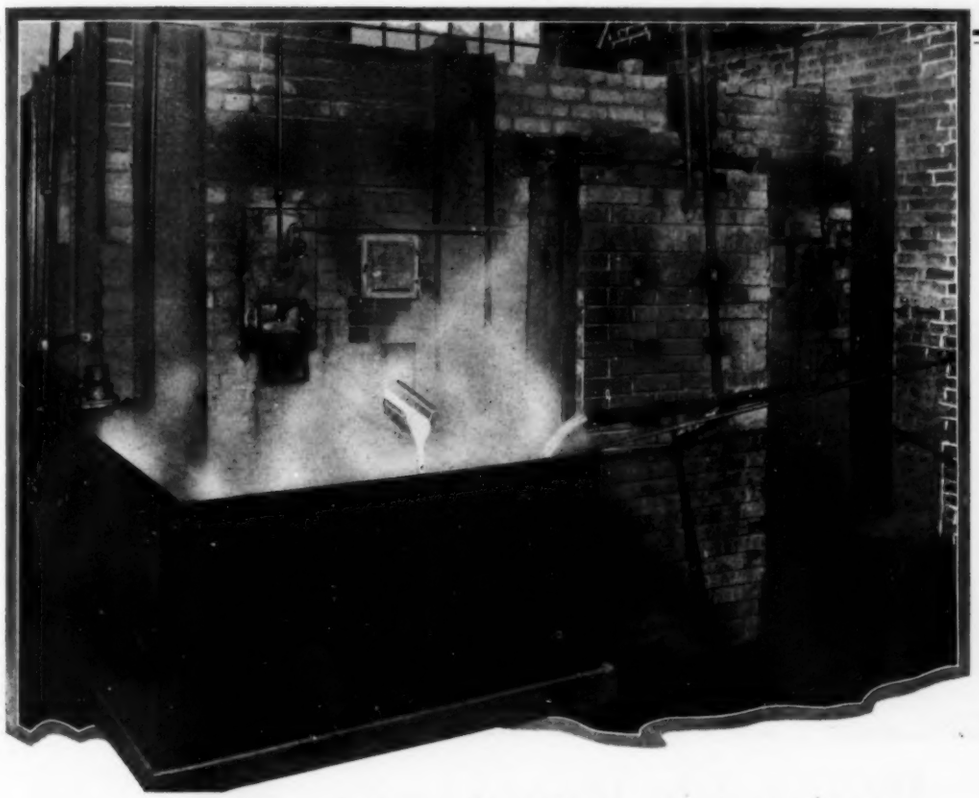
TOWER FILLING

A most efficient baffling for absorption towers, rectification columns, gas purifiers and many other uses.

Write for illustrated Bulletin No. 21.



BREGEAT CORPORATION *of* AMERICA
15 East 40th St., New York City
Sole licensees for the United States.



This enamel furnace in the plant of the Seeger Refrigeration Company, is insulated with Nonpareil Insulating Brick.

Profit by Good Insulation

Write for this book and sample Nonpareil Insulating Brick.

IT is easy to realize that insulation is an essential when you consider that as much as 15% of the total heat generated in a furnace built only of refractory and common brick is lost by conduction and radiation. And the logical way to insulate furnaces is to build Nonpareil Insulating Brick into the setting.

Nonpareil are molded and kiln burned brick, made principally from diatomaceous earth. They are uniform and strong in structure and can safely be built into walls and arches behind the refractory in place of a course of common brick. And their conductivity is so low that a single 4½-in. course will reduce radiation loss 60% to 75%.

On other equipment, too, such as hot tanks and vats, stills, dryers and ovens, boiler settings—wherever the temperature behind the refractory does not exceed 1600° F., Nonpareil Brick will save fuel, increase capacity, reduce heating-up time, improve the quality of a product and better working conditions.

A copy of the 72-page book, "Nonpareil Insulating Brick," and a sample brick will be mailed on request. If you have any insulating problems, at any temperature from 40 deg. below zero to 2500 deg. above, submit them to the Engineering Department. There is no obligation.

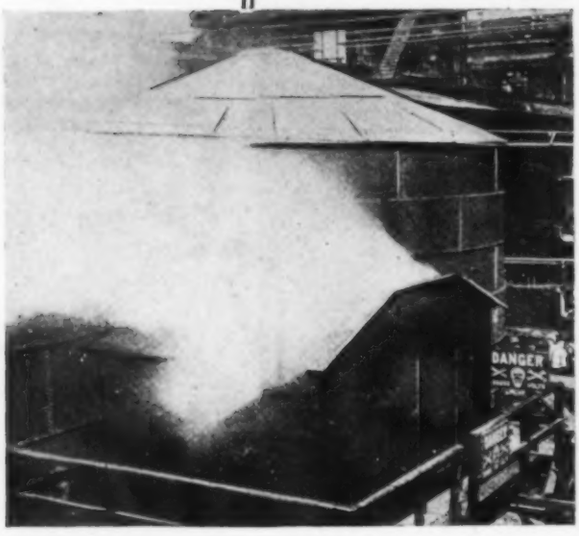
ARMSTRONG CORK & INSULATION COMPANY
Division of Armstrong Cork Company
156 Twenty-fourth Street, Pittsburgh, Pa.

Nonpareil Insulating Brick

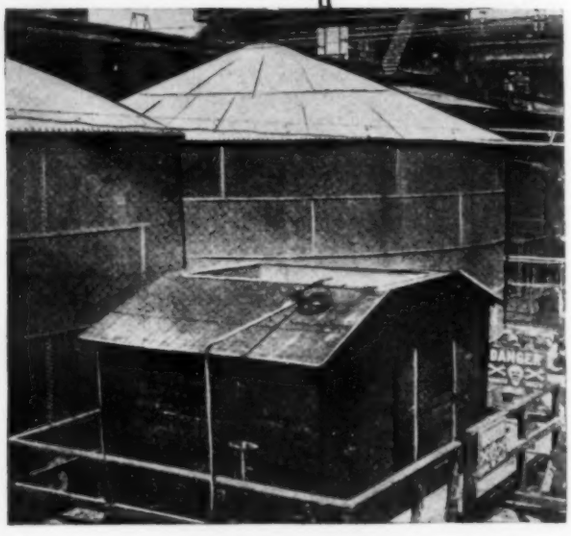
For Furnaces and Ovens

L-316

COTTRELL
Electrical Precipitation PROCESS



CURRENT OFF
Dirty gas passing through precipitator but not being treated.



CURRENT ON
Same volume of gas issuing as before but precipitator now clearing.

Profitable Recoveries *of* SO_3 and Acid Mist *from* Cooled SO_2 Gases

Other Recoveries

Tar and Oil from Combustible Gases.
Sulphuric and Hydrochloric Acids.
Metallurgical Fume from Smelting and Refining Furnaces.
Ash dust, from Powdered Fuel Boiler Plant Gases.
Black Ash and Sulphate Salts in Pulp and Paper Plants.
And Numerous Others

YOU will be interested in the authentic Cost Data we have gathered, showing substantial net profits in Industrial use of the Cottrell Electrical Precipitation Process for the collection of sulphuric acid mist from the exit gases of fresh and sludge acid concentrators; purifying cold SO_3 gas in contact acid plants, etc.; as well as the removal of dust from hot SO_3 gas from roasters burning sulphur ores, especially pyrites.

In fact, wherever the Cottrell Process has been applied for the cleaning of gases and the recovery of suspended particles in Chemical, Metallurgical and allied plants, a worth-while return to the user has resulted.

If you will consult with our engineers, they can tell you definitely what its possibilities for profit are in your field.

RESEARCH CORPORATION

NEW YORK
25 W. 43rd St.

CHICAGO
343 S. Dearborn St.

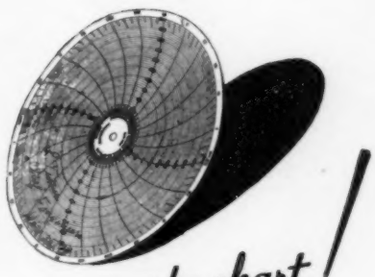
COTTRELL Systems for Greater Profits

TODD OIL BURNING MANUAL

Combined in very readable book form is that information on oil burning, oil terms, and burner operation which all users of Process Steam should know. We call this book the

TODD OIL BURNING MANUAL

A copy is yours for the asking.



The test is in the chart!

THE demands on Process Steam Plants are usually so varied that with the old time methods of steam generation it is next to impossible to constantly and satisfactorily meet all requirements.

In the Todd Oil Burning Manual the basic principles of steam generation are explained, and accurate data given on how to obtain the steam supply you need — when you need it.

There are many benefits in the use of oil fuel:

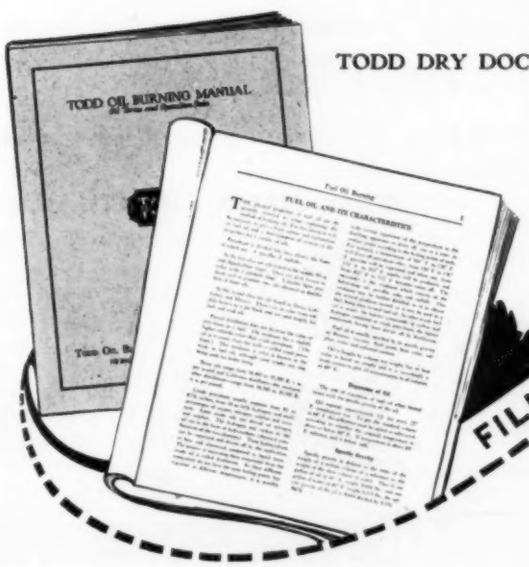
1. *No ashes to handle.*
2. *No coal to pass.*
3. *No ash cans to buy.*
4. *No coal scoops to buy.*
5. *No fluctuating steam pressures.*
6. *No coal bunkers, thus making available valuable space.*

And, in addition, these positive advantages:

7. *Automatic Operation*
8. *A Clean Boiler Room.*
9. *Less Labor.*
10. *Overloads quickly obtained.*

TODD
NEW YORK, U.S.A.

TODD DRY DOCK, ENGINEERING AND REPAIR CORPORATION
Foot of 23d Street
Brooklyn, New York



FILL IN—TEAR OFF—MAIL NOW!

Please send to the undersigned a complimentary copy of your book

TODD OIL BURNING MANUAL

Name .....

Street Number .....

City ..... State .....

The base of Laboratory results

The ability and care of the chemist
The precision and quality of instruments

Every good chemist realizes the great value of the proper laboratory equipment, the necessity of quality apparatus and supplies.

"DFC" is organized to furnish complete laboratories, whether your laboratory requirements cover the most extensive research needs or smallest assembled laboratory for student use.

Since 1876 "DFC" has been the supply headquarters for thousands of engineers, metallurgists and chemists in the industrial field.

A DFC 602 page illustrated catalog will prove of interest to buyers of laboratory apparatus. Write for copy, stating name, firm, position.

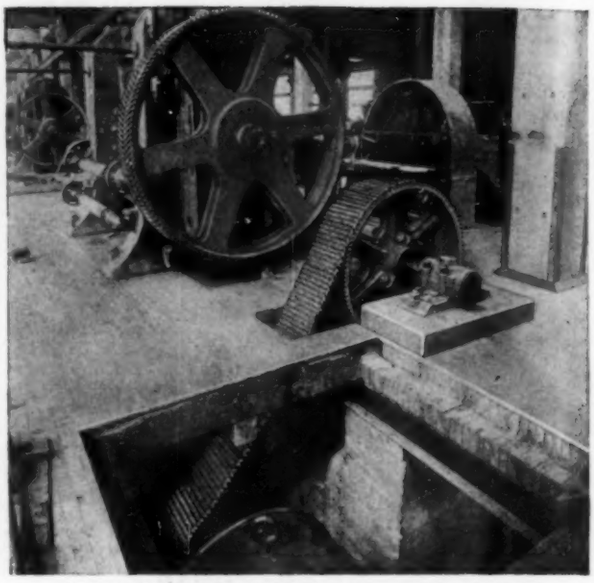
The Denver Fire Clay Co.

Denver, Colo., U. S. A.

Salt Lake City El Paso New York City

DFC

MORSE SILENT CHAIN DRIVES



150-hp. Morse Silent Chain Drive from motor to calender. Speed reduction—driver, 600 r.p.m., driven, 105 r.p.m., 72-inch centers

More Power In Less Space

Not only do Morse Silent Chains save valuable floor space because they can be run on such short centers, but their sustained efficiency of 98.6% saves power otherwise wasted. Their great durability makes for years of economical and dependable operation of machinery of every type.

Over 5,000,000 hp. installed, many still in use after 15 and 20 years of service. One-tenth to 5,000 hp., 6,000 to 250 r.p.m. and slower, especially suitable for short center drives.

Transmission Engineers, experienced in your power problems, are always available. Booklet, "A Chain of Evidence," on request.

Consult Morse engineer at nearest office

MORSE CHAIN CO., ITHACA, N. Y., U. S. A.

ATLANTA, GA., 702 Candler Bldg., Earl F. Scott & Co.
BALTIMORE, MD., 1402 Lexington Bldg.
BIRMINGHAM, ALA., Moore Handley Hardware Co.
BOSTON, MASS., 141 Milk St.
CHARLOTTE, N. C., 404 Commercial Bank Bldg.
CHICAGO, ILL., 112 W. Adams St.
CLEVELAND, OHIO, 421 Engineers Bldg.
DENVER, COLO., 211 Ideal Bldg.
DETROIT, MICH., 7601 Central Ave.
LOUISVILLE, KY., 516 W. Main St. E. D. Morton Co.
MINNEAPOLIS, MINN., 413 Third St., Strong-Scott Mfg. Co.
NEW ORLEANS, LA., Queen and Crescent Bldg., 334 Camp St., A. M. Lockett & Co., Ltd.
NEW YORK CITY, N. Y., 50 Church St.
OMAHA, NEB., 727 W. O. W. Bldg., D. H. Braymer Equipt. Co.
PHILADELPHIA, PA., 803 Peoples Bank Building.
PITTSBURGH, PA., Westinghouse Bldg.
SAN FRANCISCO, CALIF., Monadnock Bldg.
ST. LOUIS, MO., 2137 Railway Exchange Building.
TORONTO, 2, ONT., CAN., 50 Front St. E. Strong-Scott Mfg. Co.
WINNIPEG, MAN., CAN., Dufferin St., Strong-Scott Mfg. Co.
BUFFALO, N. Y., Ellicott Square Bldg.

At the Chemical Equipment Exposition

(Cleveland Public Auditorium—Week of May 10, 1926)

the many visitors at our booth were interested in the diversified line of Chemical Laboratory Equipment which we exhibited.

Our display included:

Analytical Balances	**Exax Graduated Glassware**
Water Stills	**Oil Testing Apparatus**
Drying Ovens	**Cement Testing Apparatus**
Pyrex Glassware	**Kjeldahl Distilling Apparatus**
Zeiss Microscopes	**C. P. and Analyzed Chemicals**

Warner and Swasey Polishing Machine

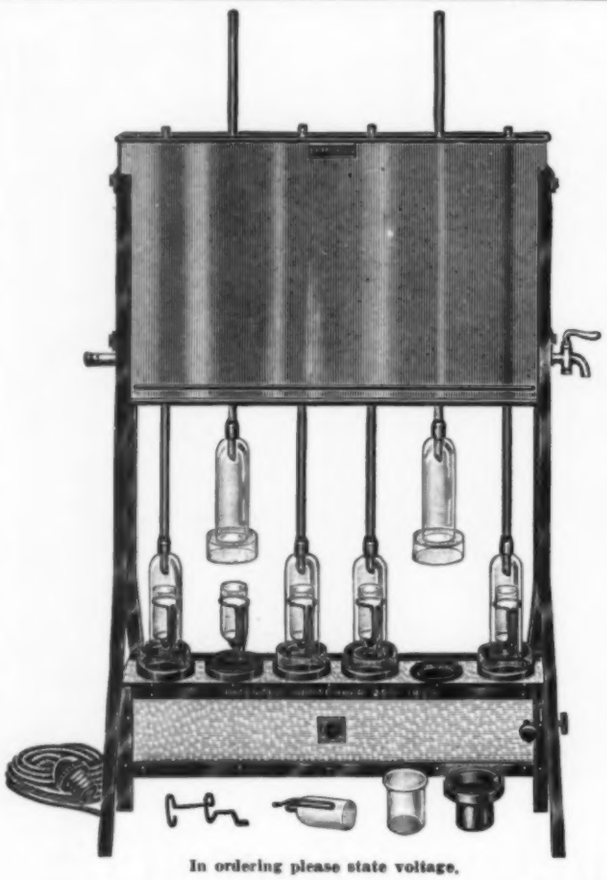
Every piece of apparatus in this exhibit is carried in stock for immediate shipment.

These items and many more listed and described in our catalog "B," copy of which will be gladly sent without charge to professional chemists and educational laboratories.

THE CHEMICAL RUBBER COMPANY

Laboratory Apparatus and Chemicals

W. 112th St. and Locust Avenue CLEVELAND, OHIO



In ordering please state voltage.

Sargent's Electric Extraction Apparatus

Type "B"—Patented

The latest design of extraction apparatus, which eliminates all joints except one mercury joint so constructed that the mercury trough always remains in place. The heating chamber is electrically operated, and the temperature is adjustable.

A beaker is used in place of a flask, affording easier access to the dried extracted matter and for cleaning.

The sliding condenser tubes and thermostatic control are covered by our patents; other patents cover our special features.

Price, as illustrated.....$90.00

Descriptive circulars upon application

E. H. SARGENT & CO.
Laboratory Supplies
155-165 East Superior St. Chicago

Chemicals and Scientific Apparatus

of all kinds

LABORATORY SUPPLIES

including FILTERING PAPER and GLASSWARE

HENRY HEIL CHEMICAL CO.

Established 1866 St. Louis, Mo.

"they conform to definite standards"

Merck's Laboratory Chemicals

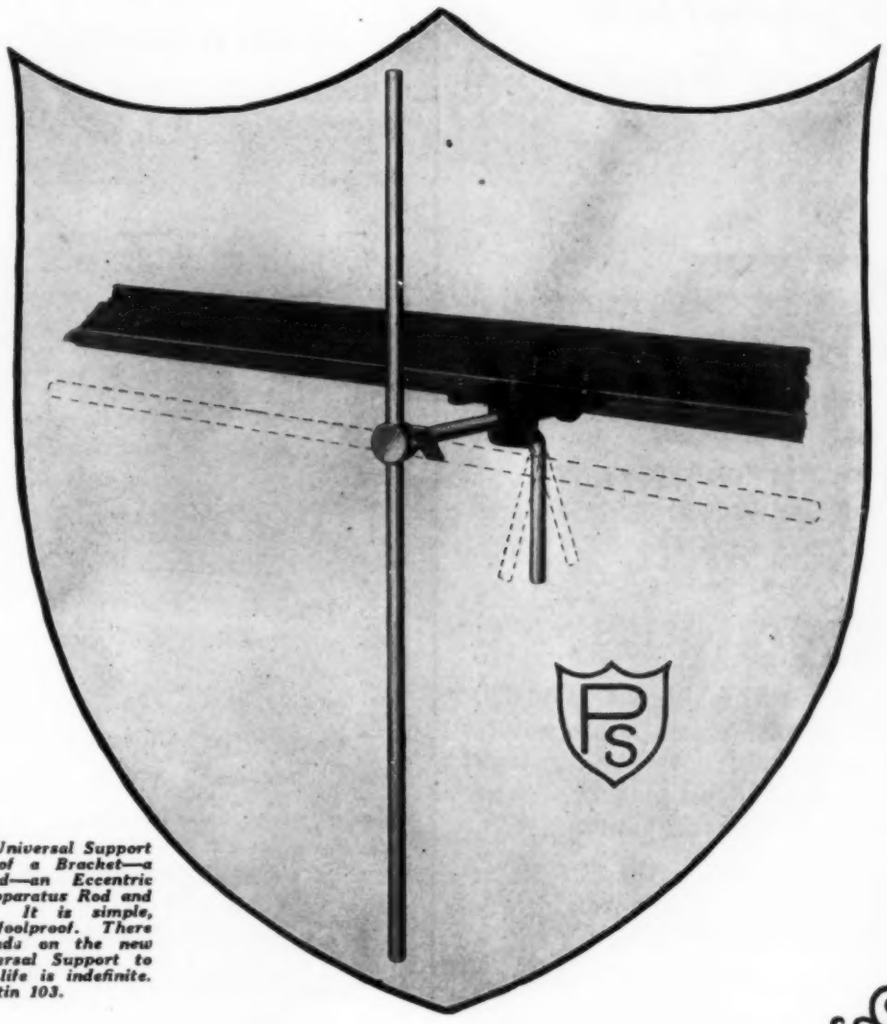
"C. P." Chemicals—*Standardized*

Embracing the majority of chemicals used in miscellaneous and experimental work. Uniform and dependable.

Blue Label Reagents

Conform strictly to Murray's "Standards and Tests," widely accepted as an authority on Reagents

MERCK & CO., 45 Park Place, New York



The Farmer Universal Support consists of a Bracket—a Bracket Rod—an Eccentric Lever—an Apparatus Rod and Thumbscrew. It is simple, durable and foolproof. There are no threads on the new Farmer Universal Support to rust and its life is indefinite. Ask for Bulletin 103.

Makes Work Easy for the Chemist

The Farmer Universal Support was particularly designed to eliminate the many short-comings of the old-fashioned laboratory stand.

A cluttered desk or table, broken glassware, limited room—all these disadvantages are quickly overcome by installing the Farmer Universal.

The chemist or student can accomplish more work as the Farmer can be used for several tests and by several students—and when their work is finished, they simply shove it back under the bottle rack.

The Farmer Universal Support is securely fastened to the bottle rack by four screws, making a strong, rigid support. It is easily adjustable, foolproof and will last indefinitely.

NU-POLAR WATER STILLS

PRECISION WATER STILLS

PRECISION LABORATORY HEATERS

PRECISION LABORATORY HOT PLATES

FARMER UNIVERSAL SUPPORT

SARGENT AUTOMATIC GAS CALORIMETER

SARGENT WET TEST GAS METER

PRECISION LABORATORY METAL WARE

Satisfy yourself! Just drop us a line or card and we'll gladly send a Farmer Universal on approval. No obligation.

Sold by all leading jobbers of laboratory supplies.

Precision Scientific Company

818 S. Tripp Avenue **Chicago, Illinois**

④

Kewaunee Laboratory Furniture

Chemical Laboratory Desk and Hood

No. 15025

11 ft., 11 in. long by 2 ft., 3 in. wide. Top of birch, body of selected oak, Alberene stone sink.

Testing and Research Laboratories

—very important. Probably $500,000,000 annually is saved by American manufacturers as a result of laboratory research work, according to estimates of the United States Chamber of Commerce.

One large manufacturer wrote as follows regarding the Kewaunee Laboratory Furniture installed in his plant:

"We are very well satisfied with the results which we have obtained from the use of this furniture, as we find it all that you claimed for it. The tables are as flat and free from warping as when installed."

We can help you decide what equipment is necessary and how to supply it most economically. Write for a copy of the Kewaunee Book. Address all inquiries to the factory at Kewaunee.

Kewaunee Mfg. Co.
LABORATORY FURNITURE EXPERTS

C. G. CAMPBELL, *Treas. and Gen. Mgr.*

106 Lincoln St.
Kewaunee, Wis.

New York Office:
70 Fifth Avenue

Branch Offices in Principal Cities

Chemical Laboratory Desk

No. 15010

A very complete desk of new design. The acme of quality and construction.

LaMotte

H-Ion Roulette Comparator

Patent applied for

The Comparator "DeLuxe"

The ideal equipment for accurate control of acidity and alkalinity in all research and industrial work.

Full Information Sent on Request

LaMotte Chemical Products Co.

416 Light Street Baltimore, Maryland, U. S. A.

PETERSON Laboratory Furniture

Combination Laboratory Table Hood and Balance Table No. 986

Where Quality Counts!

In the class room or in the laboratory, wherever quality counts, you will find Peterson Furniture. Only those using it can appreciate the great care we have taken to meet the exacting demands of instructors, school officials and expert chemists.

Every Peterson design is based upon a thorough knowledge and a full understanding of the actual conditions prevailing where the equipment is to be used. Each article is constructed by skilled craftsmen from selected materials. That is why Peterson Furniture gives so many years of satisfactory service. Quality does count, in furniture as in everything else.

Write for Catalog No. 14-G

LEONARD PETERSON & CO., INC.
Manufacturers of Guaranteed Laboratory Furniture
OFFICE AND FACTORY
1222-34 Fullerton Ave., CHICAGO, ILL.
New York Sales Office: Knickerbocker Bldg., 42nd and Broadway

A Hammered Platinum Crucible

For Determination of Volatile Matter In Coals and Coke

THIS crucible, designed for the determination of volatile matter in coals and coke, is fitted with a capsule cover. It is made in sizes from 10cc. to 90cc. inclusive. The table gives detailed information as to weights, capacities and diameters.

All the metal in our laboratory ware is guaranteed to conform to the standard of purity recommended by the United States Bureau of Standards.

Let us send you our book *Data Concerning Platinum*. You will find it valuable.

Capacity in CC.	Approximate Weight in Grams	Diameter and Depth in Cm.	Capacity in CC.	Approximate Weight in Grams	Diameter and Depth in Cm.
8	10	2.2	50	55	4.4
10	12	2.5	60	67	4.7
15	17	3.0	70	71	5.0
20	23	3.3	80	74	5.3
25	28	3.5	90	76	5.4
30	34	4.0	100	87	5.6
40	44	4.2	110	98	5.7

BAKER & CO., INC.

54 Austin St., Newark, N. J.

30 Church St., New York 5 So. Wabash Ave., Chicago

ACID-ALKALI-AND-FLAME-RESISTANT NON-ABSORBENT NON-CONDUCTING

A SUMMARY OF SUPER-QUALITIES

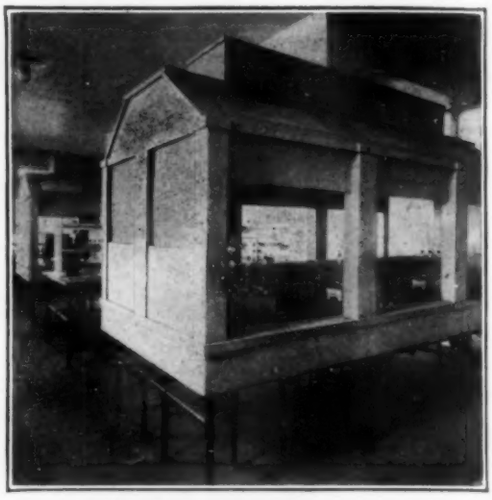
Because it is an age-old natural stone—non-absorbent and non-staining—acid-and-alkali-proof—flame-resistant and heat-proof—hard and smooth—non-splitting, non-chipping, non-scaling—easily machined in any form and assembled with liquid-and-gas-tight joints, without exposed metal—Alberene Stone is the Preeminent Material for

Table Tops and Backs Sinks and Tanks
Fume Hoods Peg Boards Shelving
Acid-Proof Floor, Base, Trim,
Wainscot, Cabinet Work, Etc.

Its use is a permanent economy—it is the most economical material you can buy, for the purposes stated.

Ask us for the Laboratory Bulletin.

ALBERENE STONE COMPANY
153 WEST 23rd STREET, NEW YORK
Baltimore Boston Buffalo Chicago Cleveland Newark
Philadelphia Pittsburgh Richmond St. Louis



In the Laboratory of a Steel Plant

ALBERENE STONE

QUARRIED FOR OVER 40 YEARS
THE INDESTRUCTIBLE MATERIAL FOR LABORATORY USE
STANDARD ALSO FOR TOILET, URINAL AND SHOWER PARTITIONS, STAIR TREADS, ELECTRICAL CONSTRUCTION

MICROSCOPES

Made by BAUSCH & LOMB

WHAT are your Microscope needs? In the Bausch & Lomb line there is a microscope to meet every laboratory, plant, or research need—Chemical, Bacteriological or Metallurgical.

B & L Microscopes have very accurate, coarse and fine focusing adjustments; circular revolving stage with graduated milled edge; adjustable substage; Nicol prism polarizer; and Glan-Thompson prism analyzer.

Particular care has been given to the finish of these Microscopes. They cannot be affected by ordinary reagents, alcohol or acids.

Ask your nearest dealer, or write direct to the company giving as nearly as possible all details on your requirements. Complete details will be sent you on our general line with specific recommendations covering your individual needs.

BAUSCH & LOMB OPTICAL CO.

601 St. Paul Street, ROCHESTER, N. Y.

New York Boston Chicago San Francisco London

Platinum (APW) Electrodes

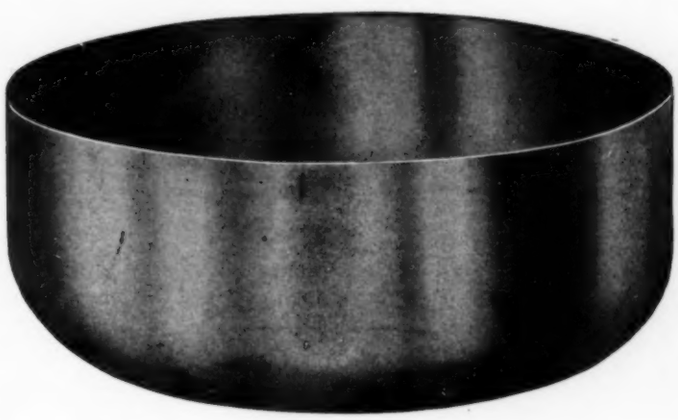
for continuous accurate performance

Platinum Electrodes, while primarily associated with delicate chemical determinations must have in addition sufficient mechanical strength to endure countless determinations and not fail at critical periods.

There are two ways to make electrodes strong, one by adding bulk of metal, but the better way, the (APW) way is to attain a maximum degree of strength by means of proper construction methods.

(APW) Electrodes are designed to give the chemist the fine degree of accuracy so essential in electrochemistry and the stability to give these results without interruption over a long period of time. They are constructed as if of one piece, wherever joints or seams occur, these are firmly united by welding and not by solder or rivets. The frequency with which welded electrodes are specified testifies as to their superiority.

Anode A.S.T.M. Specifications



Cathode A.S.T.M. Specifications

WE MAKE Electrodes for the laboratory in all sizes, rotating or stationary, in wire, sheet, perforated sheet and gauze, for standard or Special methods and for all recognized electrolytic apparatus, also any type of the small forms as used for conductivity apparatus.

Platinum as required by the various electrochemical processes.

Let us send you catalog E-15 describing APW WARES.

American Platinum Works New Jersey Railroad Avenue at Oliver Street **Newark, N.J.**

Cable Address: AMPLATCO, NEWARK

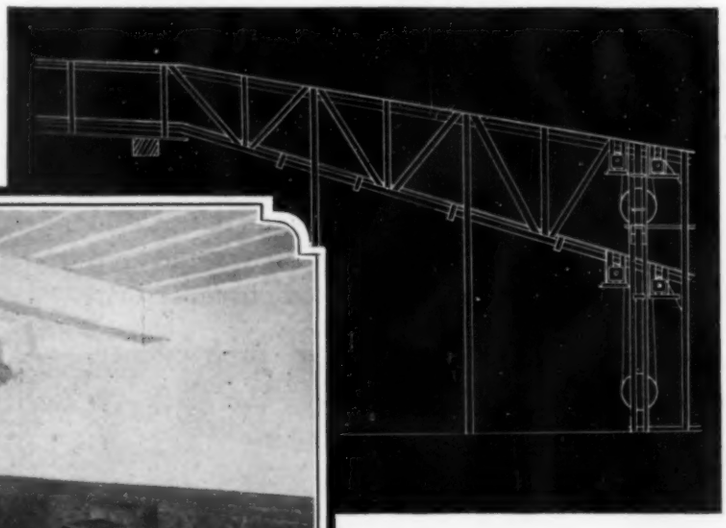
New York Office: Charles Engelhard, 30 Church Street

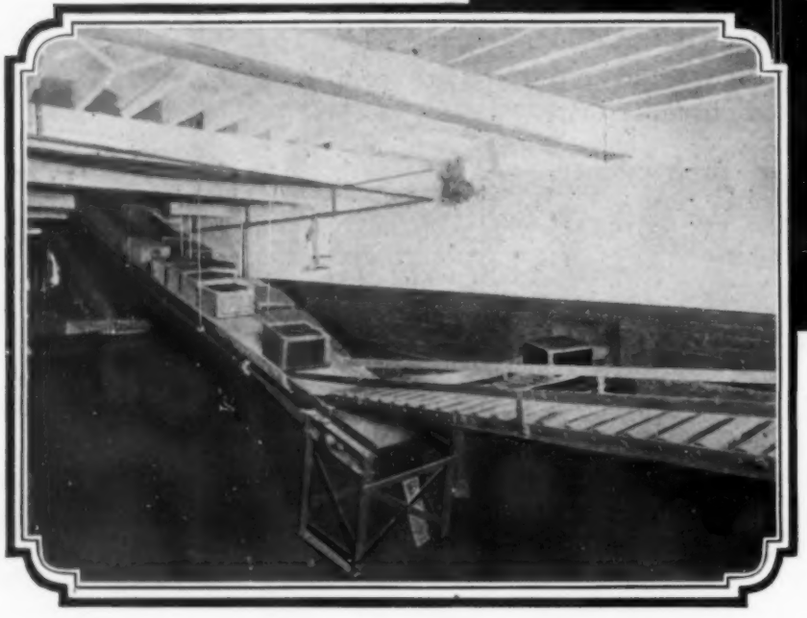
Standard Conveyors Also Help Make Soap

In the illustration below to the left—cartons of soap may be seen sliding onto a gravity roller conveyor. Ten, twenty or fifty trucks and truckers couldn't handle the volume carried away by this one unit of conveyor. The soap cartons would pile and block all progress. The truckers and trucks would form a scene of miniature traffic congestion.

Standard Conveyors are rather proud of this job of theirs. They make soap or help make it. They do not add anything to the quality of the product—but they take away part of the cost. Just a fraction of a penny from each bar perhaps—but in so doing, they help keep the selling price down, and the production up. Yes, Standard Conveyors are soap makers. They, however, do not stop there, they also help make chewing gum, candy, automobiles and sugar. They also assist in foundries, tire companies, and battery manufacturing plants.

If you build or make, warehouse or distribute something, we can tell you where Standard Conveyors are helping someone in a business like yours.





A survey of this soap manufacturer's plant showing how the conveyor system saves more than $30,000 annually will be loaned if you care to look it over.

STANDARD
CONVEYOR COMPANY, NORTH SAINT PAUL, MINN.

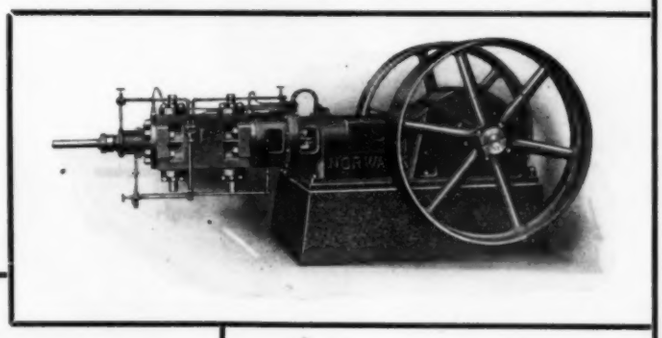
New York, 405 Lexington Avenue
Chicago, 549 West Washington Street
Philadelphia, 3110 Market Street
Cleveland, 1108 Hippodrome Building
Indianapolis, 404 Lombard Building

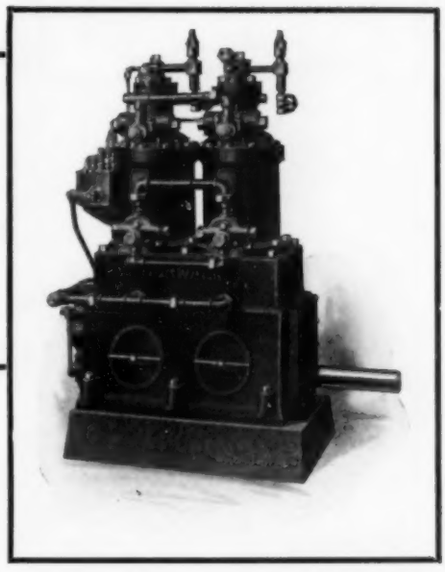
Kansas City, 419 Manufacturers' Exchange Building
Milwaukee, 209 Grand Avenue
Los Angeles, 502 Grosse Building
Seattle, 1105 Second Avenue
Charlotte, P. O. Box No. 131

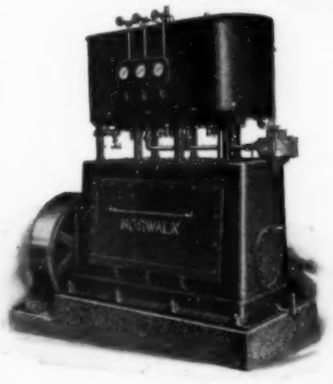
Cable Address: Gravity

NORWALK

AIR & GAS COMPRESSORS







Any quantity at any pressure from the NEW NORWALKS

And, we should add:—

For any length of run with cool, silent operation under the most severe plant conditions.

These Compressor facts should be carefully noted:—

1. The first Compound Compressor was designed and built by the Norwalk Company. It revolutionized "compression engineering" at that time (1880).

2. The first 3,000 pound Compressors were built by the Norwalk Company. Another piece of pioneer work.

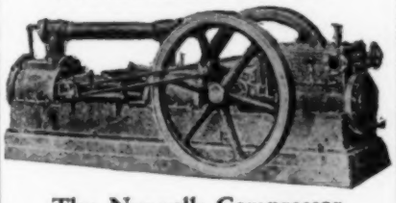
3. The Norwalk Company has laid out machines to develop 10,000 pounds pressure, and we are prepared to build compressors for higher pressures if necessary. We are continuously supplying machines of 5,000 lbs. capacity in standard sizes.

4. The Norwalk Company builds compressors to handle any compressible gas, at any pressure the receiving equipment is built to withstand.

Let us send you full descriptive data on the compressor which fits your needs. There is a standard design in the New Norwalk line. Get the facts today!

THE NORWALK COMPANY
Established 1865
S. NORWALK, CONN.

COMPRESSOR-OLOGY



The Norwalk Compressor of 1881

Pattern No. 2—Despite the cost of producing the first Compound Compressor in 1880, and the controversies such a radical departure stirred up among engineers, Mr. Hill went ahead with his machine—designing, redesigning, developing and improving—and in 1881 he brought out Pattern No. 2.

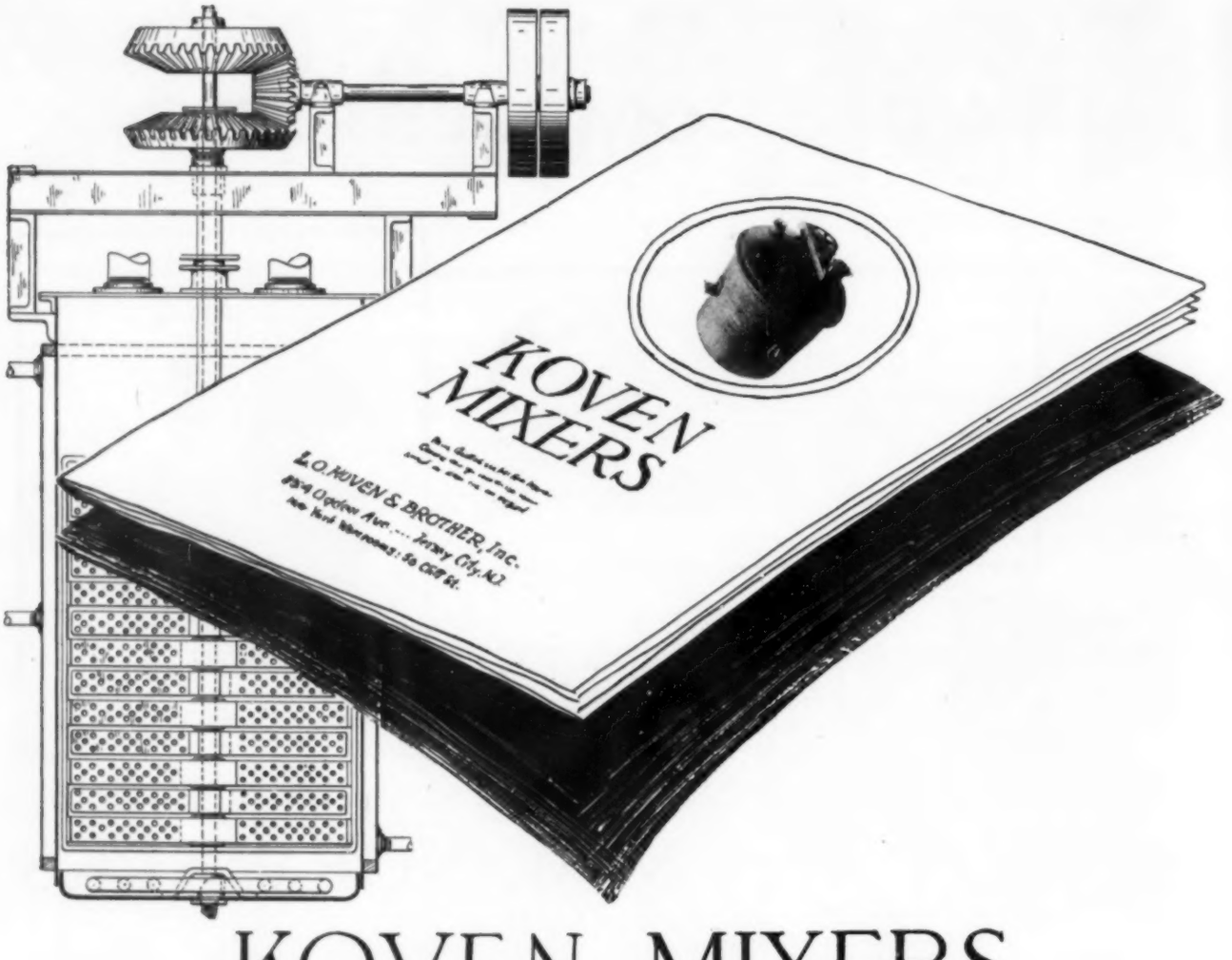
In the first pattern, it was discovered that the air at the entrance to the second cylinder was not perfectly cooled by the water jackets, and in Pattern No. 2 an intercooler containing tubes cooled by water circulation was added, and other improvements made.

Thus from the very start, we have worked continuously to improve "Compressor Engineering." How successful we have been is a matter of record.

Today our success is reflected in the

NEW NORWALKS

As fine as engineers can design—as reliable as money and 60 years experience can build—the New Norwalks—



KOVEN MIXERS

A book you should have

Because, it will help you choose the exact type of mixer for the kind of product you handle.

Because, in it you will find an infinite number of possible combinations of component parts.

Because, things you may never have thought about in regard to your mixing equipment will be brought to mind from the data in this book.

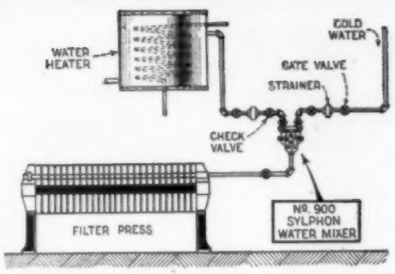
And, because it will enable you to better visualize the complete engineering service, design and manufacturing facilities the KOVEN Plant can put at your disposal.

Send for your copy today!

L. O. KOVEN & BROTHER, INC.
154 Ogden Avenue, JERSEY CITY, N. J.

DESIGNERS ENGINEERS L.O. KOVEN & BROTHER, *Inc.* FABRICATORS *to the* PROCESS INDUSTRIES

Two widely different but equally profitable uses of Sylphon Automatic Temperature Control



Mixer delivering exact temperature of water to insure thorough washing of precipitate; to avoid spoilage and assure regularity.

Sylphon TRADE MARK

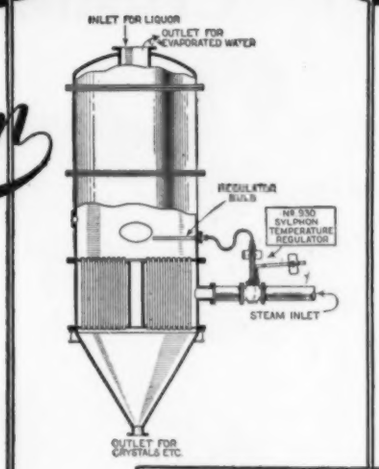
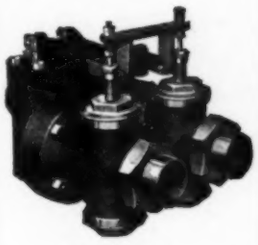


Illustration shows how simply a Sylphon Temperature Regulator can be installed on all types of evaporators.



Front View.

Sylphon Thermostatic Water Mixers are supplied at various ratings from 50 deg. F. up. They automatically deliver water at the exact temperature required, and each mixer can also be quickly adjusted to deliver water 10 deg. above or below the rated delivery point.

Obviously, there are many very specific applications of Sylphon Water Mixers in practically any chemical plant, where their use will be profitable.

End Inefficient Hand Control

These two installations typify the extensive applications of Sylphon Regulators in the chemical field.

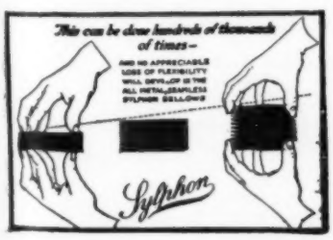
The No. 930 Sylphon Regulator on the evaporator replaces inefficient hand control of steam, thereby preventing boil-overs, spoilage, and waste due to excessive temperatures, particularly when the vacuum breaks, or is lost for any reason.

The Sylphon Thermostatic Water Mixer automatically delivers wash water for press cake at the exact temperature required, assures rapid, thorough washing, and eliminates process troubles due to the use of water at improper temperatures.

No. 930 Sylphon Temperature Regulators are especially adaptable to the control of the temperatures of liquids in stills, kettles, impregnators, extractors, dye vats and other equipment where a series of different temperatures is required in the course of an operation.

Sylphon Regulators Are Easy to Install And Require No Supervision or Repairs

The illustrations show how simply Sylphon Regulators are installed, and that there are no complicated or delicate accessories to get out of order. Once installed and set, Sylphon Temperature Regulators and Water Mixers function automatically without attention or repairs of any kind.



Sylphon Temperature Regulators are all based on the well-known Sylphon Bellows—the most accurate, flexible and durable expansion unit known. This bellows is the source of the motive power which provides for Sylphon automatic control.

Your Process Will Benefit By Sylphon Automatic Control

Let us show you where and how Sylphon Regulators will improve quality, prevent spoilage and waste, save steam, and speed up production in your plant.

Bulletins ET-105 and EW-100 cover many typical chemical plant installations. Ask for both of them.

THE FULTON COMPANY KNOXVILLE, TENN.

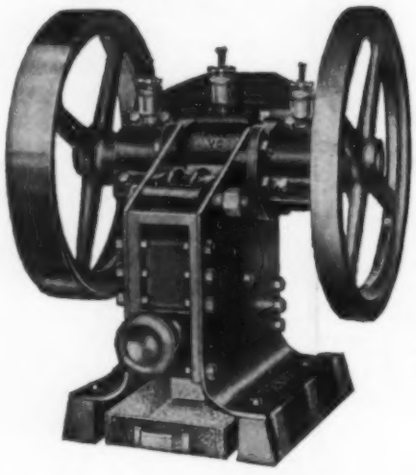
ORIGINATORS AND PATENTEES OF THE SYLPHON BELLOWS

Sales Offices in: New York, Chicago, Detroit, Boston, Philadelphia and all the principal cities in U. S.

European Representatives:
Crosby Valve & Engineering Co., Ltd.
41-42 Foley Street
London, W. 1, England

Canadian Representatives:
Darling Bros., Ltd.
120 Prince Street
Montreal, Canada

Braun Chipmunk Crusher



Here is a Real Laboratory Machine

Steel Frame, Strong and Sturdy

The downward throw of the Jaw movement impels the discharge making it adaptable for crushing both hard and soft material.

Easily cleaned. Readily adjusted. The bearings are fitted with split bushings easily taken up or renewed.

Type WC-16 with power pulley.....**$165.00**
Type WC-18 with T & L pulleys..... **190.00**

Will reduce rock from about 2¼ inches down to ¼ inch and smaller at a rate of 1500 pounds per hour.

Requires 2 h.p.

Braun Laboratory Appliances Standard the world over!

THE BRAUN CORPORATION

SAN FRANCISCO HOUSE
BRAUN-KNECHT-HEIMANN-CO.

363 NEW HIGH ST.
LOS ANGELES, CALIFORNIA, U. S. A.

BRAUN SERVICE IS WORLD WIDE

Zinc Shavings	Borax Glass	Pyrex Glassware
Cyanide	Mercury	Crucibles
Sodium Sulphide	Calmix Cupels	Chemicals and Reagents

Busch

PHOTOMICROGRAPHIC CAMERA

Used with any Standard Microscope

The adjustable stand is equipped with a scale and vernier so the position at which photographs are made may be recorded.

Size of Photo 3¼ x 4¼
Price.....$45.00

Write for Busch Bulletin 615B

PALO COMPANY
Apparatus for Industrial and Laboratory Use
153 West 23rd Street, New York, N. Y.

If CORROSION *is one of your problems— investigate* PYREX

- Tubing
- Piping
- Pipe Fittings
- Cylinders
- Pots
- Sheet Pyrex
- Evaporating Dishes
- Trays
- Retorts
- Pollers
- Sight Glasses
- Electrical Insulation, etc.

HIGHLY resistant to acids, heat, and sudden temperature changes, PYREX is replacing metal installations in more and more industrial plants.

Especially where corrosion is a factor, or visibility is desirable, it will prove worth your while to investigate the possibilities of this unique installation material.

Pyrex engineers may be of assistance in solving some of your manufacturing problems—as they have done for many of the country's great industrial organizations.

* * *

The services of these Pyrex engineers are available to you without cost or obligation. Write for further information.

CORNING GLASS WORKS
Industrial and Equipment Division
Corning, New York

It can be done!

by the Wakefield Amalgamated Exclusive Process

HOMOGENEOUS PERFECT BOND

Metal and lead lining are fused together into an amalgam—graduating into pure lead for contact; without possibility of separation at any point.

Take for instance, a PERMANENT lead lining for Iron Pipe!

Some users of "lead lined" iron pipe have gone so far as to declare it couldn't be done—until they put "Wakefield Amalgamated" into use.

They discovered that a "Wakefield Amalgamated" installation was *permanent*. All scales and blisters had been removed. There were no weak spots in the uniform lining to afford entrance to corrosion. The "Wakefield Amalgamated" exclusive process gave a *perfect* bond. The pipe couldn't help but last indefinitely.

Such methods are typical of those employed in the manufacture of all "Wakefield Amalgamated" products during the past 34 years—and proved by actual records of installations. Write for the whole story of what the "Wakefield Amalgamated" quality-standard means and how it pays users.

LEAD-LINED IRON PIPE CO.

Established 1892

Pioneers and Leading Manufacturers of Lead-Lined Equipment

WAKEFIELD, MASS., U. S. A.

Lead lined "Amalgamated" Acid-Resisting Products, Lead Covered "Amalgamated" Products, and Block Tin Covered "Amalgamated" Products. Including Pipe, Fittings, Valves, Stop Cocks, Soil Pipe and Fittings, Tanks, Coils, Tubes, Sheets, Agitators, Fans, Special Apparatus.

"WAKEFIELD AMALGAMATED" lead-lined products

Chemical Engineers Metallurgists Chemists — Professional Directory — Laboratories Research Service Patent Attorneys

HOWARD W. AMBRUSTER
CONSULTANT
Arsenic, Calcium Arsenate and Insecticides
Preliminary surveys of world conditions and final estimates and reports on supply of raw materials, plant construction, marketing.
261 BROADWAY, N. Y.
Cable Ambruschem

D. C. DYER
CHEMICAL INFORMATION SERVICE
United States and Foreign Patent and Literature Investigations for Research Development or Litigation.
(Preliminary or Complete Reports)
Translations
292 Madison Ave, NEW YORK — Telephone Vanderbilt 2467

V. P. KRAUSS
Consulting Chemist and Chemical Engineer
Development and improvement of manufacturing processes
Design, construction and maintenance of machinery, equipment and buildings for the paint, varnish, color and chemical industries.
4137 171st Street, Flushing, L. I., N. Y.

APOTHECARIES HALL COMPANY
Analytical and Consulting Chemists
Established 1849
Waterbury — Connecticut

GENERAL ENGINEERING RESEARCH CO.
CHICAGO, ILL.
Electrical—Chemical—Mechanical
Research & Development
Consulting
149 Huron St., Chicago, Ill.

NELSON LITTELL
U. S. and Foreign Patents
Infringement and validity opinions.
Patent and Trademark Litigations.
475 Fifth Avenue, New York.

RAYMOND F. BACON
Chemical Engineer
INDUSTRIAL RESEARCH
50 East 41st St.
New York City

PHILIP O. GRAVELLE
Photomicrographs — Technical Microscopy
Photographs made through the microscope for the comparison of materials used in metallurgical, paint, paper, textile and other industries; from botanical, zoological and pathological preparations.
114 Prospect Street, South Orange, N. J.

A. E. MARSHALL
Specialist in Mineral Acids and Fertilizer. Manufacture, Consultant on Chemical Plant
Design and Practice.
Cable Address: Techemik, Balto
3034 St. Paul Street
Baltimore, Md., U. S. A.

BARFOED & GIBSON
Consulting Engineers
Hydroelectric Developments
Transmission Systems
Electrochemical Applications
1901 Hobart Bldg.,
San Francisco, California

JOSEPH W. HARRIS
Chemical, Electrochemical, Metallurgical Electrical Patents.
Washington Loan and Trust Bldg.,
Washington, D. C.

"From Research to Plant in Operation"
MEIGS, BASSETT & SLAUGHTER
Incorporated
CHEMICAL ENGINEERS
Research—Design—Engineering
Reports on Projects for Financing
Drexel Bldg. — Philadelphia

W. N. BERKELEY, Ph. D.
(Formerly Chief Chemist, U. S. Navy Engineering Experiment Station.)
CONSULTING CHEMIST
Advice on selection and use of Fuels and Lubricants. Industrial Water Treatment—Investigations and Reports.
295 Fifth Avenue — New York

NEVIL MONROE HOPKINS
Invention and Patent Engineer
CHEMICAL AND METALLURGICAL PATENTS
25 West 44th Street, New York

C. L. PARKER
Ex-Examiner Chemistry
U. S. Patent Office
Attorney-at-Law and Solicitor of Patents
McGill Bldg., WASHINGTON, D. C.

CLEMENT S. BRAININ, Ph.D.
Consulting Physicist and Physical Metallurgist
Physical Metallurgy of the Precious Metals and Alloys
General Spectrum Analysis.
505 Fifth Ave., New York

ROBERT W. HUNT CO.
Engineers — Chemists
Metallurgists — Inspectors
Examinations, Reports on Properties and Processes
2200 Insurance Exchange, CHICAGO

HARRISON E. PATTEN
Chemistry, Electrochemistry, Colloids, Foods, Reports and Research
SILVER SPRING, MARYLAND

CROSS ENGINEERING COMPANY
(Engineering Department of K. C. Testing Laboratory)
Combustion and Oil Refinery Engineers
700 Baltimore Ave., KANSAS CITY, MO.
Telephones Main 1327-1328

LOUIS CLEVELAND JONES
HARALD AHLQVIST
Chemists and Engineers
Alkali — Plants
Ammonia — Processes
By-products — Surveys
Foreign Information Appraisals.
331 Madison Ave., New York, N. Y.

DR. WALTHER PFLUG
Former Examiner
of the German Patent Office
Advice in German Patent and Trade Mark Cases.
24 Hohenstaufen Str. — Berlin W. 30
Germany

DWIGHT & LLOYD SINTERING CO.
Special Problems in Ore Treatment
29 BROADWAY, NEW YORK
Cable, "Sinterer"

KNIGHT & CLARKE
Successors to DR. P. C. McILHINEY
Analytical and Consulting Chemists
Official Chemists, U. S. Shellac Importers Assn.
50 E. 41st St., New York City
Murray Hill 6821

THIS DIRECTORY
is known throughout the Chemical and Metallurgical Field as a logical medium through which to locate responsible engineers.

Professional Directory

LUCIUS PITKIN, INC.
Analytical — Consulting — Research
CHEMISTS and ASSAYERS
Metallurgists
Ferro, Non-Ferrous and Platinum Metals
47 Fulton Street New York City

IVAN P. TASHOF
Chemical and Metallurgical Patents
VICTOR BLDG., WASHINGTON, D. C.

H. ED. WIEDEMANN
(Estd. 1905)
Consulting and Analytical Chemist
Chemical Bldg. Saint Louis

S. S. Sadtler E. C. Lathrop
SAMUEL P. SADTLER & SON, INC.
CONSULTING & ANALYTICAL CHEMISTS
CHEMICAL ENGINEERS
Established 1891
210 S. 13th St., Philadelphia, Pa.

TECHNICAL SERVICE COMPANY
Chemical Engineers
Preliminary Surveys, Industrial Appraisals, Estimates and Designs for Complete Plants, Processes Developed and Improved, Factories Located.
WOOLWORTH BUILDING
New York City

WEISS AND DOWNS
Chemists and Chemical Engineers
50 East 41st Street, New York City
Cable: Weidowes

FOSTER D. SNELL, Ph.D.
Research Chemist
Process Development Research
Viscose Consultations
Utilization and Disposal of Industrial Waste.
196 CLINTON AVE., BROOKLYN, N. Y.

JOHN E. TEEPLE
Consulting
Investigating
Managing
Since 1904.
50 East 41st Street, New York City

THE J. G. WHITE ENGINEERING CORPORATION
Engineers—Contractors
Design and Construction of Chemical Plants, Oil Refineries and Pipe Lines. Reports and Appraisals.
43 Exchange Place, NEW YORK

Industrial Testing Laboratories

EKROTH LABORATORIES
INCORPORATED
CHEMISTS *Since 1889* ENGINEERS
Consultations
Investigations Analyses
Technical Researches and Development
Plant Design and Supervision
461 Eighth Ave. *(Penn. Sta.)* New York

INDUSTRIAL TESTING LABORATORY, INC.
Analytical and Consulting Chemists
Chemical Engineers
114 West 10th St., Kansas City, Mo.
Telephone Victor 7015

LOS ANGELES TESTING LABORATORY
Chemists, Assayers and Engineers
1300 S. Los Angeles St., Los Angeles, Cal.
Telephone Westmore 5646

ELECTRICAL TESTING LABORATORIES
Tests
80th St. and East End Ave.
NEW YORK, N. Y.

KANSAS CITY TESTING LABORATORY
Chemists and Engineers
700 Baltimore Ave., Kansas City, Mo.
Telephones Main 1327-1328

N.Y. TESTING LABORATORIES
Metallurgical and Chemical Engineers
Metallographers
Physical and Chemical Analyses of Iron, Steel, and Non-Ferrous Alloys, Ores, Paints, Cements and Asphalt. Metallurgical Photo Micrographs. Consultants, Investigators, Inspectors of Materials in Smelting, Foundry, Drop Forging and Heat-Treating Practices.
80 Washington St., NEW YORK CITY

HOCHSTADTER LABORATORIES
INC.
CHEMICAL ANALYSES, CONSULTANTS, TECHNICAL EXPERTS, INVESTIGATIONS, LITIGATION
Coal, Oils, Water, Foodstuffs, Gelatine Beverages, Dairy Products, Confectionery, Drugs, Minerals, Textile Materials, Etc.
Phone: Beekman 5260-5261
227 Front Street, NEW YORK

YOUR CARD HERE
will come to the attention of over 12,000 readers of this publication among the chemical and associated industries.

PEASE LABORATORIES, Inc.
Established 1904
Chemists Biologists Sanitarians
Consultations Litigations
41 WEST 38TH ST., NEW YORK CITY

Advertising —

as a builder of prestige and business standing is unquestioned. It is an immeasurable power in influencing new business and retaining good-will.

Professional Cards —

in this paper offer a highly appropriate type of publicity for the services of professional men in the Chemical and allied industries.

Your Card —

should appear in this directory regularly. If it is not there now—

→

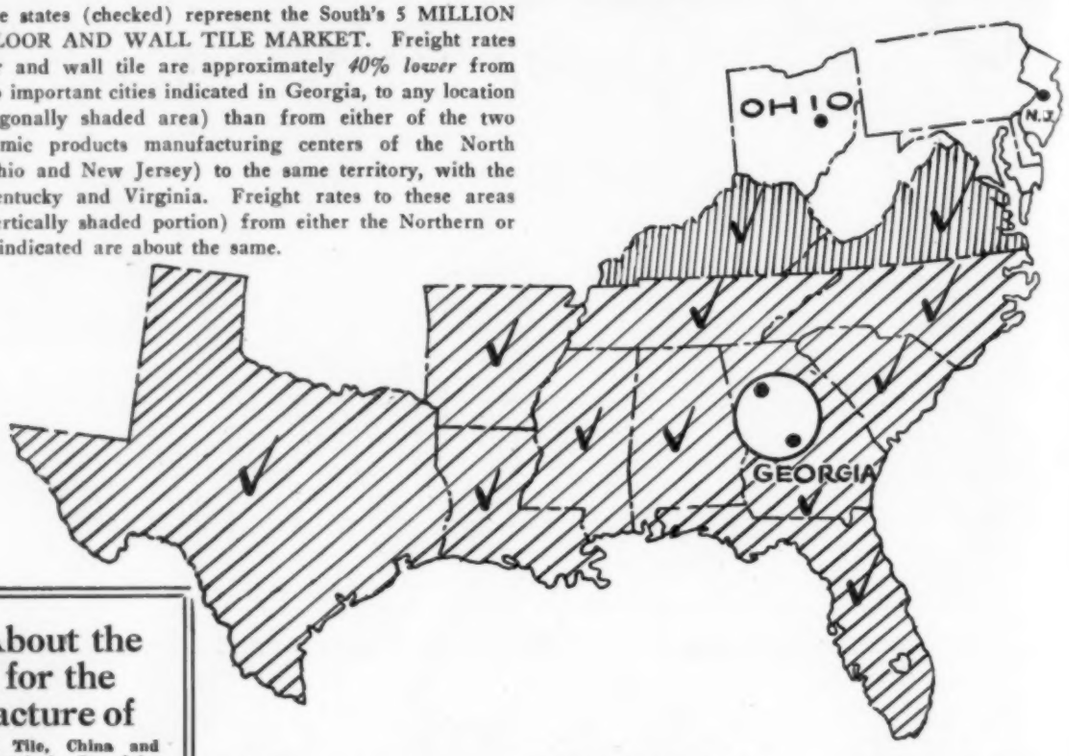
Professional Directory Department
CHEMICAL AND METALLURGICAL ENGINEERING
10th Ave. at 36th St., N. Y.

Gentlemen:

Please send us rates and other data for advertising in your PROFESSIONAL DIRECTORY.

.....
.....
.....
.....

THESE twelve states (checked) represent the South's 5 MILLION DOLLAR FLOOR AND WALL TILE MARKET. Freight rates on finished floor and wall tile are approximately *40% lower* from either of the two important cities indicated in Georgia, to any location within the (diagonally shaded area) than from either of the two established ceramic products manufacturing centers of the North (indicated in Ohio and New Jersey) to the same territory, with the exception of Kentucky and Virginia. Freight rates to these areas (indicated by vertically shaded portion) from either the Northern or Southern points indicated are about the same.



Facts About the South for the Manufacture of

Floor and Wall Tile, China and Tableware. Electrical Porcelain, Sanitary Ware and Refractories.

Raw Material Resources

FELDSPAR — North Carolina produces nearly 50% of the country's output.

BALL CLAY—Kentucky and Tennessee produce 83% of the entire output of the country.

KAOLIN OR CHINA CLAY—Georgia produces 40% of the entire output of the country.

FLINT—Abundant supply in Georgia and Alabama. Not mined to any extent due to present lack of demand.

Present Market for Ceramic Products

Based on the consumption of twelve representative Southern States, the present market for several ceramic products, in dollars, is as follows: China and Tableware, 12 million: Electrical Porcelain, 5 million: Floor and Wall Tile, 5 million: Sanitary Ware, 8 million: Refractory Brick and Shapes, 14 million.

Future Market

The South's ever increasing building operations promise to continue for many years to come, creating an increased and steady demand for all classes of ceramic products. The South is carrying out an extensive expansion program. Contracts for elaborate Schools, Churches, Hotels and many other building operations are being awarded constantly.

Low Building Material Costs

The following figures are the average costs of building materials in Georgia—Common building brick $11 to $14 per thousand. Cement $3 per barrel. Crushed Stone $1.25 to $1.65 per ton. Lumber $24 to $60 per thousand feet.

Favorable Labor and Fuel Costs

Common labor costs run from 20 to 40 cents per hour. Fuel oil at present ranges from 6½ to 7½ cents per gallon. Coal costs from 3.50 to $4.50 per ton. Hydro-electric power lines cover the western, middle and northern sections of Georgia.

Here's a 5 Million Dollar Floor and Wall Tile Market *that is also a Raw Material Source—*

yet 95% of its Floor and Wall Tile consumption is supplied from Northern ceramic products manufacturing centers, that *draw their raw materials from within the very territory of this extensive market!*

Consider for a minute the excessive raw material assemblage cost and distribution of finished product cost, of Northern Floor and Wall Tile manufacturers selling in this Southern market! There is the long-haul of raw materials to Northern points and likewise the return long-haul of finished products to distribution centers of the South! It is hardly conceivable in the face of this worthwhile and expanding market, that at present there are no Floor and Wall Tile plants of any consequence in the South serving the South—yet it is a fact!

The branch plant of a Northern Floor and Wall Tile manufacturer, located in Georgia on the above map, would enjoy a *40% lower material assemblage and distribution cost* in serving the Southern market! From the states checked above every raw material for high grade Floor and Wall Tile manufacture is available in abundance.

Decentralize your operations—establish a branch plant in Georgia and serve the Southern Floor and Wall Tile market to greater advantage than it is possible from either of the Northern ceramic products manufacturing centers!

Ask us to give you the facts. Our Industrial Department has compiled considerable up-to-date and valuable information concerning the opportunities for established Floor and Wall Tile manufacturers, in Georgia.

Also—request a copy of "Directory of Commercial Minerals Along the Central of Georgia Railway."

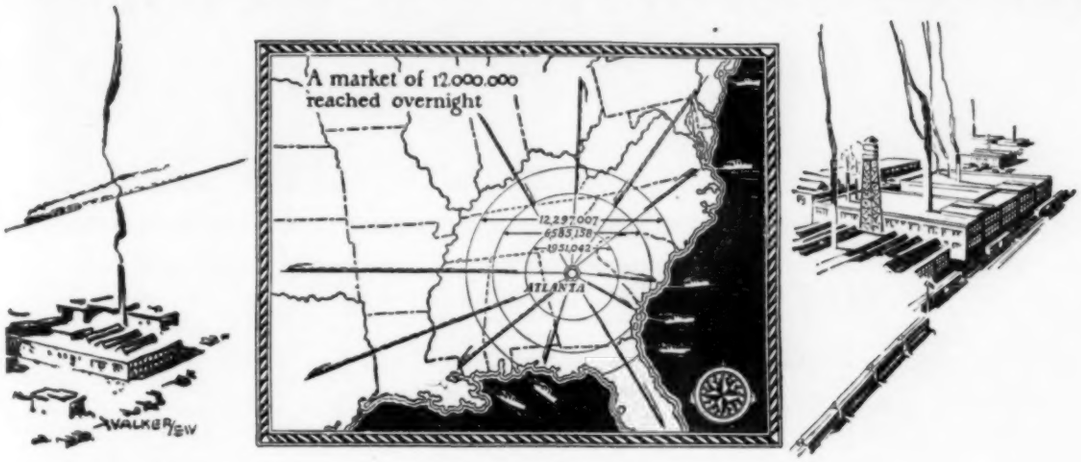
Central of Georgia Railway

J. M. MALLORY
Gen'l Industrial Agent

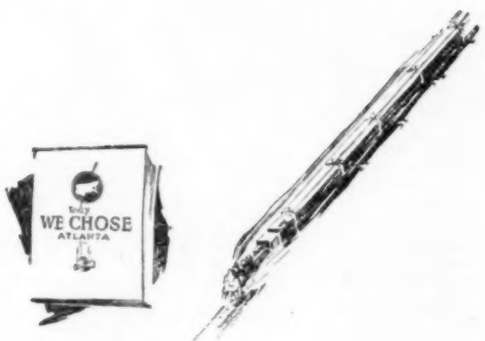
CENTRAL OF GEORGIA

233 West Broad St.
Savannah, Ga.

One Hundred Million Dollars!



The Largest Textile Deal in History for the ATLANTA Industrial Area



Send for this booklet

Containing the actual experiences of some of the 560 great concerns that have chosen to serve the South from Atlanta

GOODRICH and FISK, two great tire companies announced recently a development that with other similar developments, will within two years put 60% of the American tire fabric production, and 50% of the world's production, in Georgia and the Atlanta Industrial Area.

Why Do They All Choose the Atlanta Area?

GOODRICH, FISK, GOODYEAR — all have selected this section within the last few weeks. Why? For the same reasons that nearly six hundred nationally known concerns have also come here, representing all lines of industry.

Because of vital production economies, due to savings in Labor, Power, Raw Materials, Taxes and other vital factors—and because Atlanta is indisputably Industrial Headquarters of the South.

The Atlanta Industrial Bureau will be glad to give you the same data that has been the basis of these developments, presented from the standpoint of your business.

Write to INDUSTRIAL BUREAU
2631 Chamber of Commerce

ATLANTA

Industrial Headquarters of the South

SEARCHLIGHT SECTION

USED MACHINERY & NEW—BUSINESS OPPORTUNITIES

UNDISPLAYED—RATE PER WORD:

Positions Wanted, 4 cents a word; minimum 75 cents an insertion, payable in advance.

Positions Vacant and all other classifications, 8 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 to 3 inches.....$5.00 an inch
4 to 7 inches..... 4.80 an inch
8 to 15 inches..... 4.60 an inch

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page.

C. & M.

POSITIONS VACANT

CERAMIST wanted, graduate ceramist, (ceramic chief chemist, silicate chemist, ceramical or chemical engineer) trained and experienced in research and factory control and general business management for leading position in new ceramic industry. Single, energetic, from 35 to 40 years of age. Please state qualifications fully, condition of health and salary expected. P-581, Chemical and Metallurgical Engineering, Real Estate Trust Building, Phila., Pa.

CHEMICAL engineer or chemist wanted for research work, having some research or plant experience, preferably in salts of non-ferrous metals. Give detailed information regarding education, experience, age, nationality, religion, references, and salary desired. P-606, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

EXPERIENCED chemist and assayer for mine and smelter work; Peru, South America. Cerro de Pasco Copper Corporation, Room 1502, 44 Wall Street, New York.

FURNACE expert wanted for selling, installing and operating new type of automatic temperature control equipment for gas-fired and oil-fired furnaces and electrical ovens and furnaces, also steam heated processes. Must have real practical knowledge of furnaces and experience with automatic control. Engineer or metallurgist preferred who desires extensive traveling, visiting great numbers of industrial plants. In answering advise experience. Fine opportunity for right man. P-610, Chemical & Metallurgical Engineering, Tenth Ave. at 36th St., New York.

METALLURGICAL engineer junior (single) to act as assistant smelter test engineer large copper mine, Chile, South America. Three-year contract, transportation both ways, and salary while traveling paid by company. In reply give complete details. P-578, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

WANTED, young man trained in chemistry, who has had experience in compounding. Prefer man who has worked on tapes such as friction and surgeon's tape. Good opening for one who can work with present department in development work. P-608, Chemical and Metallurgical Engineering, 7 So. Dearborn St., Chicago, Ill.

EXECUTIVE MANAGER WANTED

A large corporation is seeking a high grade, technically trained, executive who knows production from all angles and who is familiar with the higher executive duties of general management. The position calls for a real progressive, around 40 years old, who has rapidly climbed to large responsibilities with a constructive record of achievement along the most modern business lines. Full details with photograph, are desired.

P-570, Chem. & Met. Engrg.
Tenth Ave. at 36th St., New York City.

EMPLOYMENT SERVICE

IF you are qualified for position between $2,500 and $25,000, and are receptive to negotiations for new connection, your response to this announcement is invited. The undersigned provides a thoroughly organized service, established sixteen years ago, to conduct confidential preliminaries, and assist the qualified man in locating the particular position he desires. Not an employment agency. Retaining fee protected by refund provision, as stipulated in our agreement. Send name and address only for description of service. R. W. Bixby, Inc., 260 Main Street, Buffalo, New York.

EXECUTIVES, engineers, find our individual, confidential service effective in making new connections. Personally planned by Mr. Jacob Penn, the eminent employment authority, known to leading business men throughout America. Refund agreement protects you. Not agency. Jacob Penn, Incorporated, 305 Broadway, New York.

EMPLOYMENT AGENCIES

GENERAL engineering agency, Emich Bldg., Pittsburgh, Penna. Requires for transcontinental correspondence proposals: Chemists, metallurgist, combustion engineers, for cadet and experienced service in coke, textiles, paints, refining, furnace production, under $225 month.

POSITIONS WANTED

CHEMICAL engineer, American, 36, 12 years operation administration nitrate fields, Chile. Desires connection as technical executive for operations. Latin America. PW-573, Chemical and Metallurgical Engineering, Real Estate Trust Building, Philadelphia, Pa.

CHEMICAL engineer, American, 36, married, employed December to June of each year in tropics as superintendent of manufacture and refining of sugar and byproducts, seeks work for five months, July to November, each year. Best of references. PW-604, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL engineer, B.S. from engineering college in 1916. Age 32, married, steady and reliable. Plant and laboratory experience mostly organic, leather, rubber, resins, insulation materials, and formulation of adhesives and cements. Development and plant work preferred. PW-612, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMICAL engineer, twenty-eight years old, university graduate with seven years' industrial experience in distillation processes, desires new connection, petroleum or coal carbonization work preferred. Good references. PW-607, Chemical and Metallurgical Engineering, 1600 Arch St., Phila., Pa.

CHEMICAL engineer, with 10 years' experience in responsible positions in charge of research development and manufacturing of different chemical products, and with sales experience, desires a position as a sales development engineer or as a manager of a chemical industry. PW-601, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

CHEMIST, Ph.D. Specialist in physical chemistry, now teaching in a University in Greater New York, is open for position either in research or plant administration. Eleven years' experience, three as plant executive, two as analyst. PW-596, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

POSITIONS WANTED

CHEMIST, 37, university graduate in chemical engineering, 14 years' experience, principally in charge of laboratories in metallurgical and ceramic industries, and as research chemist, some organic experience, now employed, desires change. Western location preferred. PW-575, Chemical and Metallurgical Engineering, 883 Mission Street, San Francisco, Calif.

CHEMIST, one year's experience in coal and ferrous metallurgical analysis. University education. At present employed. PW-602, Chemical and Metallurgical Engineering, Guardian Bldg., Cleveland, Ohio.

GERMAN chemist, graduate, 39, 15 years' experience in laboratory and industry (1 of these in America), now employed as industrial chemist, desires position as analytical or research chemist. Have developed new processes, one for better yield and purification of wool fat. Available immediately. Vicinity of New York preferred. PW-605, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

MECHANICAL engineer, technical graduate, 10 years' responsible experience handling maintenance construction and process development work, seeks connection where possibilities are offered. At present employed as works engineer responsible for engineering work, maintenance of mill, the purchase of technical materials and the development of new methods. PW-603, Chemical and Metallurgical Engineering, 1600 Arch St., Phila., Pa.

RESEARCH engineer and chemist; four years' experience on combustion problems, three years in varied analytical work, chiefly inorganic. Have made special study of furnaces and their design. PW-613, Chemical and Metallurgical Engineering, Tenth Ave. at 36th St., New York.

STEEL expert, 15 years' experience in the heat treatment of steels and alloys. Thorough training in metallurgy and metallography. Desires position as inspector or charge of heat treating plant. J. W. Mills, Transcona, Manitoba, Canada.

SALESMEN AVAILABLE

SALESMAN for Mid-west territory in pigment or chemical industries. Age 34, university graduate in chemistry, nine years' experience with same company in selling and production, desires sales or executive position with high-grade, progressive pigment or chemical company. Proven ability, large following in many industries. SA-611, Chemical and Metallurgical Engineering, Guardian Bldg., Cleveland, Ohio.

EXECUTIVE

Available for new developments, for Assistant to the President, or management and superintendence. Clear and successful record of unusually well diversified and seasoned production experience over a period of years, and which includes much pioneering development work, organization and management. Technically trained. Initial salary and title of secondary importance to a connection affording real future opportunity against demonstrated ability.

PW-614, Chem. & Met. Engineering
Tenth Ave. at 36th St., New York City

REPRESENTATIVES AVAILABLE

Sales Engineer

Representative with exceptionally successful record of sales promotion, would like to communicate with a company of standing which is interested in obtaining exceptional representation. Have had chemical plant equipment office in Philadelphia for past six years. Close personal relations with majority of the leading chemical and allied plants in the Eastern States. RA-609, Chemical and Metallurgical Engineering, 1600 Arch St., Phila., Pa.

BUSINESS OPPORTUNITIES

Diatomite

is employed for many purposes and its uses are being increased and developed almost daily. It is the best known fireproofing, sound-proofing, insulating and filtering material; perfect for metal and auto polish; cannot scratch. Many other uses. I own and offer for sale two hundred acres of Florida Diatomite in lakes, average depth of material more than 18 feet; pronounced by highest authorities the finest quality known, practically 100 per cent pure silica; no sulphur, iron, sand or other deleterious substance. Very simple manufacturing process, at cost of $7.00 per ton. Rail and motor transportation right at hand, and water transportation only four miles distant. Exceptional opportunity for highly profitable business. Will retain substantial interest if desired. For full particulars address Wisdom D. Brown, 1311 G St. Washington, D.C., or Astor, Fla.

BOOKS AND PERIODICALS

For Sale

Jour. of Soc. Chem. Industry. London. Vols. 1-37. Indices. Vols. 1-22 bound cloth; rest unbound. Fine condition. $175. Address A. T. Waller, Morristown, N. J.

"Engineering Advice on Factories"
Specialists in

FACTORIES

For Sale or Lease

The service and advice of Chemical engineers with extensive plant experience is available to executives in aiding them to locate suitable factories.

TECHNICAL SERVICE CO.
Woolworth Bldg., N. Y. C. Whitehall 8412

TIME CLOCKS-LOCKERS STORAGE CABINETS

STEEL PARTS BOXES — STEEL SHELVING

(New Bargains)

International Time Recording Time Clocks. Style 1116. Cost $292. Our price $125. Two-color, automatic. Out of town shipments $10 additional for crating.
Steel Clothes Lockers, hat shelf, hooks, 3-way lock, all sizes, attractive prices.
Double Door Steel Storage Cabinets, 36x18x78 adjustable shelves, lock and keys, each, $29.75, F.O.B. Cars, Aurora, Ill.
Send for our Bargain Catalog.

NEW YORK MACHINERY CO.,
Dept. C. & M.—200 Fifth Ave., N. Y. C.

SEARCHLIGHT SERVICE SECURES SATISFACTORY SITUATIONS

G-23

DEPENDABLE EQUIPMENT

(From our own stock—prompt shipment)

MILLS

No. 1 K-B Pulverizer.
30-in. Sturtevant, emery.
2—Williams Infant.
30-in.x48-in. Pebble—silex lined.
24-in.—30-in.,—36-in.—42-in.—60-in. Ball Mills.
No. 00 and No. 0000 Raymond.
2—3—4—5 Roll Raymond.

KETTLES

400 gal. Buffalo C. I. agitated.
115—275—450 gal. Steel jacketed.
350 gal. Steel agitated.

FILTERS AND FILTER PRESSES

18-in. Shriver, 23 recessed plates.
24-in. Shriver, 32—1-in. chambers.
30 and 36-in. Shriver, wood.
2—6x4 Oliver. 2—6x6 Oliver.
Type 150 Kelly, all copper.

DRYERS

48-in.x20-in. Buffalo, Vac. Drum.
40-in.x126-in. Devine Vac. Drum.
3-ft.x15-ft. Stokes Rotary Vac.
4x9 Atmospheric Double Drum.

EVAPORATING EQUIPMENT

350-sq.ft. Zaremba, single effect.
200-gal. Copper Vacuum Pan.
470-gal. C. I. open atmospheric.

Mixers, centrifugals, stills, motors, pumps, etc.
Refrigerating Equipment— (send for special list)

ROBERT P. KEHOE MACHINERY CO.
7 East 42nd Street, New York. Telephone Vanderbilt 9594-9595
Main Storage and Yard: 730 to 736 E. 141st St.

KELLY FILTERS

Loaned
Bought
Sold
Thoroughly Overhauled

All Kinds of Repair Parts at Fair Prices

Emil E. Lungwitz
90 West St., New York, N. Y.

FOR SALE

EVAPORATORS

SINGLE EFFECTS

1—J. P. Devine & Co. 5-ft. x 11-ft.; Copper Tubes, 300 sq.ft.
1—J. P. Devine & Co. 7-ft. x 16-ft.; Steel Tubes, 1560 sq.ft.
1—Swenson, 300 sq.ft. Copper Tubes.
1—Swenson, 600 sq.ft. Copper Tubes.

Used on Food Products. Like New.

E. E. NORRIS
140 S. Dearborn St., Chicago

ATTRACTIVE OFFERINGS

Available for immediate shipment a complete stock of Filters, Dryers, Centrifugals, Columns, Evaporators, Grinders, Kettles, Mixers, etc.
All equipment in guaranteed good operating condition.

UNITED UTILITIES, INC.,
17 West 60th St., New York City

WANTED

WANTED

Idle Plant Equipped with Machinery

W-599, Chemical & Metallurgical Engrg.
Tenth Ave. at 36th St., New York City

WE WANT YOUR

PLATINUM SCRAP

IN ANY FORM

We pay highest market price, make prompt returns and hold goods for your approval.

I. MILLER, Smelter and Refiner
252 Colonial Arcade, Cleveland, Ohio

WANTED

ROTARY KILN

7x110-ft., must be in first class condition. Address

W-600, Chemical & Metallugical Engrg.
Tenth Ave. at 36th St., New York City.

We are Buyers of:

Pipe Lead Scrap
Sheet Lead Scrap
Lead Sludge
Lead Drosses
and Lead Bearing Alloys.

Metallurgical and Chemical Corp.
Subsidiary of
National Lead Co.
Matawan, N. J.

MACHINERY BARGAINS

FOR SALE

AUTOCLAVES

5—Experimental Autoclaves, 1 to 3 gals.
2—40-gal. Steel Autoclaves.
1—80-gal. Steel Autoclave.
1—150-gal. Jacketed Steel Autoclave.

MIXERS and KETTLES

12—Horizontal Mixers, 25 to 40 gals.
1—175-gal. J. H. Day Mixer.
2—900-gal. Horizontal Steel Mixers.
2—20-gal. Experimental Kettles.
1—50-gal. Experimental Mixer Kettle.
1—100-gal. Jacketed Mixer Kettle.
2—150-gal. Jacketed Valleiron Mixers.
1—200-gal. Jacketed Pfaudler Mixer.
3—Houchine Aiken Crutcher Mixers.
1—500-gal. C. I. Jacketed Sulphonator.
5—1500-gal. C. I. Reduction Kettles.
7—1600-gal. Jacketed Nitrators.
200—"Wear Ever" Aluminum Jacketed Kettles, 40, 60 and 80 gals. capacity.
3—15-gal. Jacketed Copper Kettles.
14—60- and 80-gal. Jacketed Copper Kettles.
2—120-gal. Copper Kettles.
2—40-gal. Enamelled Jacketed Pans.
6—Enamelled Kettles, 40 to 150 gals.

FILTERS

1—30-in. Shriver-Atkins C. I. Press.
18—30-in. sq. Wooden Filter Presses.
5—24-in. sq. Wooden Filter Presses.
2—24-in. sq. Cast Iron Filter Presses.
2—18-in. sq. Cast Iron Filter Presses.
3—18-in. sq. Wooden Filter Presses.
1—30-in. dia. Steel Pressure Filter.
1—10-in. sq. Sperry C. I. Filter.
20—30-in. Filter Press Skeletons.

STILLS

2—75-gal. Jacketed Copper Stills.
1—100-gal. C. I. Mixing Still.
4—115-gal. Aluminum Jacketed Stills.
1—150-gal. Jacketed Enamelled Still.
4—Steel Stills, 150 to 2,000 gals.
3—150-gal. Jacketed Copper Stills.
3000-lb. Glycerine Unit.

EVAPORATORS and PANS

1—Devine Vacuum Evaporator.
4—Jacketed Evaporating Pans, 7 ft. x 30 in.
2—Evaporating Pans, 8 x 3 ft.

VACUUM PUMPS

20—Beach Russ Rotary Vacuum.
2—Devine, 4 x 6 in.
1—Stokes, 2-stage, 6 x 8 in.
1—Devine, 5 x 10 x 8.
1—Blaisdell, 14 x 10 in.; belted.
1—Alberger, 8 x 16 x 10.

MILLS and CRUSHERS

1—Hardinge Conical Ball Mill, 24 in. dia.
3—Ball Mills, 24 x 48 in.
1—Allis-Chalmers Rotary Hammermill.
1—Bauer Spike Roll Crusher.
1—Jeffrey Spike Roll Coal Crusher.
2—Farrel Foundry Jaw Crushers, 4 x 10 in.
Gruendler Crusher XXXX.

MISCELLANEOUS

Dings Magnetic Separator.
2—2-ton Brunswick Refrigeration Units.
2—4-ton Yorke Refrigeration Units.
1—10-ton Mayer Refrigeration Unit.
1—12-ton Remington Refrigeration Unit.
1—15-ton Automatic Refrigeration Unit.
1—Cloth Printing Machine.
6—Air Compressors, 50 cu. ft. to 600 cu. ft. capacity.

MACHINERY & EQUIPMENT CO., INC.
OFFICE, WAREHOUSE and YARDS, 225-231 Sherman Ave., Newark, N. J.
Phone: 7707-8 Waverly

SURPLUS EQUIPMENT

FOR SALE

1—Merrill Oil Heating System.
2—Deep Well Pumps.
Stoneware
Blowers
Mills
Evaporators
Centrifugals — Motors
Pumps — Coil
Fusion Kettles — Cast Iron Pot

Write for description and complete lists.

Monsanto Chemical Works,
St. Louis, Mo.

Machinery For Sale

1—No. 250 Kelly Filter.
2—6x6-ft. Oliver filters.
3—2000 gallon nitrating kettles.
3—1200 gallon reducing kettles.
1—Swenson crystallizer.
1—150 gallon heavy duty dough mixer.
1—3x20-ft., 2—4x30-ft., 2—5½x40-ft., 2—6x50-ft. rotary dryers.
1—7x100-ft., 1—6x120-ft., 2—6x60-ft., 1—4x40-ft. rotary kilns.
3, 4½, 6 and 8-ft. Hardinge mills, Raymond mills—Ball and Tube mills.
Crushers, Pulverizer and Hammer mills.
18-24-30- & 36-in. Filter Presses.
1—4x3½-ft. Buffalo Atmospheric Drum Dryer.

W. P. HEINEKEN & CO., Inc.
Industrial Engineers
95 Liberty St., New York
Tel. Han. 2450

FOR SALE

VACUUM ROTARY DRYER

J. P. Devine & Co., 5-ft. diam. & 30-ft. Complete with auxiliaries. Used four months drying Starch.

E. E. NORRIS,
140 S. Dearborn St., Chicago

FOR SALE

2 Waterloo Portable Gasoline Back Pullers

with winch head. Engine 7½ hp. motor.

F. J. LEWIS MFG. CO.
Newark, N. J.

---

2 LARGE PLANTS PURCHASED *for* LIQUIDATION!

NIAGARA ELECTROLYTIC IRON CO., U. S. SUGAR COMPANY

Immediate liquidation of equipment of these two large plants, offers exceptional buying opportunities. Sacrifice prices, prompt deliveries. Send for separate catalog on pumps, filters, belting, pans, etc. WRITE! PHONE! WIRE!

Blowers and Fans
8—Connersville, Crowell & Buffalo Forge.

Boilers
8—250 hp., Wickes Boilers 2-10 hp., Kane Gas.

Centrifugals
10—24, 26, 28, 30, 36, 42 and 48-in. Tolhurst, Amer. Ldry. and Fletcher.

Condensers
10—Copper or Iron Tubular.

Distilling Equipment
9—Copper 12, 18, 24, 28, 36, 42 and 60 inches dia.
3—Iron 24, 36 and 42 inches dia. Lummus, Badger & Case makes.

Dryers
1—Gordon "C" 280 sq. ft.
1—Gordon "D" 560 sq. ft.
3—Devine Nos. 11, 23 and 28 Vac. Shelf.
1—Buffalo 48x40-in. Vac. Drum.
4—Devine Vac. Rotary 3x6 ft., 3x25 ft., 5x30 ft.
1—Bartlett & Snow 3x25 ft. Rotary Style E.

Evaporators and Pans
4—Single, Double, Triple and Quadruple effects. Devine, Swenson & Zaremba.

Filter Presses
4—Sweetland Nos. 2, 8, 10 and 12.
16—Iron, 18, 24, 30, 36 and 42 inches square.
6—No. 450, Kelly.
2—Iron 27 and 30 inches round.
4—Wood 12, 18, 24 and 30 inches square.

Grinders and Pulverizers
5—Raymond Nos. 00, 000 and 0000.
6—Shutz-O'Neills 16, 20, 22 and 28 inches.
6—Mead Mills, Nos. 1, 2 and 3.
2—Hardinge Conical Ball Mills 3 ft.x8 in. and 10 ft.x30 in.

Kettles
20—Jack, open and closed, copper, aluminum, iron and enamelled.

Mixers
4—Werner & Pfleiderer—50, 100 and 200 gals.
2—Day Imperial Nos. 10 and 30.
7—1 bbl. Dough Mixers, not jack.
5—15 to 40 gals. Pony Mixers.

Paint and Ink Mills
3—3 Roll 9x24 and 12x30 inches Ross & Kent.
2—6 & 7 ft. overdriven Chasers.

Vacuum Stills
2—Lummus Copper Jack, 4 ft. 6 in. dia., complete with cond., scrubbers, receivers. One agitated. NEVER USED!

Vacuum Pans
2—40 and 75 gals. copper jack with aux.
2—10 ft., Vac. Coil Pans.

We are in the market to buy anything from a single item to a complete plant. Send us your lists! WE HAVE A LARGE STOCK OF EQUIPMENT AT OUR JERSEY CITY WAREHOUSE. Send for Catalogue.

STEIN-BRILL CORP., 25 CHURCH ST., NEW YORK CITY
Telephone Rector 3168-69
Cable "BRISTEN"

GOOD USED EQUIPMENT

for Immediate Delivery!

SPECIAL

8—No. 12 Sweetland Filters.
2—Batteries of 40-in. American Tool Centrifugals with Mixers. Eight machines per battery

DISTILLING APPARATUS
1—52-in. Badger Copper Column.
1—36-in. Lummus Copper Column.
1—36-in. Lummus Iron Column.
1—36-in. Badger Copper Column.
1—24-in. Lummus Copper Column.
3— 6-ft.x6-ft. Steel Stills.
1—450 gal. Copper Still.
1—350 gal. Copper Still.

AUTOCLAVES
6—250 gal. Jacketed, Agitated.
6—500 gal. Jacketed, Agitated.

VACUUM SHELF DRYERS
10—No. 12 Devine Vac. Shelf Dryers.
4—No. 23 Devine Vac. Shelf Dryers.
6—No. 25 Devine Vac. Shelf Dryers.
2—No. 27 Devine Vac. Shelf Dryers.
3—No. 58 Devine Vac. Shelf Dryers.
2—Buffalo Vac. Shelf Dryers.

ROTARY VACUUM DRYERS
1—Stokes 4-ft.x15-ft.
1—Devine 3-ft.x25-ft.
3—Scott 4½x18-ft.

DRYERS
1—Proctor Tunnel Dryer.
2—Proctor 2 Truck Dryers.
1—Gordon Shelf Dryer.
1—4-ft.x9-ft. Double Drum Atmospheric Dryer.
1—5-ft.x25-ft. Allis-Chalmers Rotary Dryer.

FILTER PRESSES, IRON
2—Shriver 42-in.x42-in.
1—Johnson 36-in.
2—Shriver 30-in.x30-in.
2—Sperry 30-in.x30-in.
1—Smith Vaile 30-in.x30-in.
2—Johnson 24-in.x24-in.
1—Johnson 24-in.x24-in., Lead.
2—Shriver 18-in.x18-in.

SWEETLAND FILTERS
3—No. 12 Sweetland Filters.
2—No. 11 Sweetland Filters.
1—No. 10 Sweetland Filters.
3—No. 9 Sweetland Filters.
1—No. 8 Sweetland Filters.
1—No. 5 Sweetland Filters.

KELLY FILTERS
1—No. 450 Kelly Filter.
2—No. 250 Kelly Filters.

PEBBLE, BALL AND TUBE MILLS
1—Alsing 11-in.x18-in. Double Jar Mill.
1—Abbe 30-in.x23-in. Pebble Mill.
1—Paterson 24-in.x36-in. Pebble Mill.
1—Abbe 30-in.x30-in. Pebble Mill.
1—Abbe 30-in.x33-in. Pebble Mill (New).
1—Abbe 30-in.x36-in. Pebble Mill.
1—Abbe 36-in.x42-in. Pebble Mill.
1—Abbe 45-in.x42-in. Ball Mill.
2—3-ft.x7-ft. Jacketed Ball Mills.
4—6-ft.x5-ft. Jacketed Ball Mills.
4—Alsing 6-ft.x5-ft. Pebble Mills.
1—Abbe 3-ft.x8-ft. Tube Mill.
1—Alsing 4-ft.x8-ft. 6-in. Tube Mill.
1—Smidth 4-ft.x16-ft. Tube Mill.
1—Allis-Chalmers 4-ft.6-in.x20-ft. Tube Mill.
2—Allis-Chalmers 5-ft.x24-ft. Tube Mills.
1—No. 32 Marcey Mill.
1—Hardinge 8-ft.x48-in. Conical Ball Mill.
1—Hardinge 8-ft.x36-in. Conical Ball Mill.
1—Hardinge 4½-ft.x16-in. Conical Ball Mill.

GRINDERS
2—0000 Raymond Mills.
2—000 Raymond Mills.
4—00 Raymond Mills.
6—28-in. Schutz O'Neil Mills.
1—22-in. Schutz O'Neil Mills.
1—16-in. Schutz O'Neill Mills.
4—No. 3 Meade Mills.
2—No. 2 Meade Mills.
2—No. 1 Meade Mills.
2—30-in. Cage Disintegrators.
2—24-in. Cage Disintegrators.
2—20-in. Cage Disintegrators.
1—4-in.x16-in. Sturtevant Balanced Roller Mill.
1—12-in.x12-in. Sturtevant Balanced Roller Mill.
1—4-in.x8-in. Sturtevant Jaw Crusher.
1—Sturtevant Hammer Mill.
1—62-in. Putty Chaser.
1—72-in. Putty Chaser.
2—20-in. Ross Burr Stone Mills.
2—30-in. Ross Burr Stone Mills.
5—42-in. Munson Burr Stone Mills.
3—48-in. Kent Burr Stone Mills.
1—Ross 16-in.x40-in. Roller Mill.
2—Ross 12-in.x30-in. Roller Mill.

REDUCERS
1—1,600 gallon Buffalo (New.)

EVAPORATORS
2—Swenson Single Effect 250 sq.ft.
1—Zaremba Single Effect 300 Sq. Ft.
1—Swenson Double Effect 300 Sq. Ft.
1—8-ft. Cast Iron Vacuum Pan.

CENTRIFUGALS, BELTED
1—60-in. Tolhurst.
1—54-in. Hercules.
2—48-in. Tolhurst.
2—48-in. Fletcher.
2—42-in. Fletcher.
2—42-in. Tolhurst.
1—36-in. Fletcher.
4—30-in. American & Poland.
3—28-in. American & Poland.
2—24-in. American & Poland.

CENTRIFUGALS, STEAM DRIVEN
2—30-in. Fletcher.
1—32-in. Fletcher.
1—40-in. Dienelt.
2—42-in. Fletcher.
4—48-in. Fletcher.

MIXERS
1—Day Size A. Powder.
1—Day Size C. Powder.
1—Day Size D. Powder.
2—Colton Mass Mixers.
2—Ross 50 gal., Dough.
2—Day 50-gal., Dough.
3—Day 100-gal., Dough.
6—6-Barrel B. & S. Dough.
4—500 gal. Day, Jacketed Jumbo.
3—500 gal. Stokes, Jacketed Dough.
1—550 gal. Day, Jacketed.
1—1,000 gal. Day, Jacketed.
2—Size 15, 100 W. & P.

KETTLES, JACKETED, OPEN
10—40 gal. Cast Iron.
10—60 gal. Cast Iron.
6—80 gal. Aluminum
12—Copper 50 to 200 gal.
16—125 gal. Cast Iron.
1—200 gal. Steel.
20—250 gal. Steel.

KETTLES, JACKETED, AGITATED, OPEN
10—50 gal. Dopp Cast Iron.
3—50 gal. Steel.
2—85 gal. Dopp.
15—100 gal. Dopp.
5—150 gal. Dopp.
7—150 gal. Devine.
1—175 gal. Dopp.
15—300 gal. Cast Iron.
1—700 gal. Steel.

KETTLES, CLOSED, AGITATED NITRATORS-SULPHONATORS
1—110 gal. S. & P. Cast Iron.
3—150 gal. Cast Iron.
8—175 gal. Cast Iron.
2—250 gal. Cast Iron.
2—500 gal. Duriron.
1—700 gal. Steel.
1—800 gal. Buffalo Tube Type Nitrator.
1—900 gal. Cast Iron.
3—1,000 gal. Cast Iron.
1—1,800 gal. Steel.
3—2,000 gal. Cast Iron.

SULPHUR BURNERS
5—4-ft.x16-ft. Glens Falls.
2—4-ft.x20-ft. Glens Falls.

STILLS
3—4-ft.x8-ft.-6-in. Copper Digestors.
1—350 gal. Jacketed.
1—450 gal. Jacketed.
3—6-ft.x6-ft., Steel.
1—75 gallon, Copper, Vacuum.
1—100 gallon, Copper, Vacuum.
1—200 gallon, Copper, Vacuum.

AIR COMPRESSORS
2—American 6x6.
1—Ingersoll 6x6.
1—Chicago Pneumatic 9x11.
1—Laidlaw 15x12.

VACUUM PUMPS
1—Buffalo 14x14x12.
1—Worthington 14x9.
2—Devine 10x10x10.
2—Devine 6x8.

PUMPS
1—Lead Lawrence Centrifugal 3-in. x2.
1—Duriron Centrifugal 1-in.
2—Centrifugals 3-in.x2-in.

TANKS
3—6-ft.x25-ft., 5,000 gal.
6—8-ft.x18-ft., 7,000 gal.
1—9-ft.x34-ft., 14,000 gal.

DURIRON AND CORROSIRON
24—6-in.x6-ft. S-Bends.
15—Ton Piping & Fittings 1-in. to 8-in.

Consolidated Products Company, Inc.

15 Park Row New York, N. Y.

Phone: Barclay 0603, 0605. Cable Code: Equipment

LEAVE IT TO LAWLER

Save Time and Money

NOW LOCATED IN OUR NEW SHOP AND 10 ACRE YARD

WE WILL accept equipment on consignment and rebuild and sell it on commission. As Engineers and Manufacturers we know the equipment we sell—know just what service it will give. You get dependable equipment when you buy from Lawler!

Specialists in Grinding Machinery

and Manufacturers of Ball, Pebble and Tube Mills

If we do not have a used mill in stock to meet your requirements we offer NEW mills at a slightly higher price, but less than you would pay elsewhere.

Engineering Service and Advice on Mill Operation

With every mill we sell, we give expert advice on how to run it to secure the most profitable service from its use.

Tell us what you need for your plant or what you wish to do. We quote on what you specify, or if you are uncertain, we will tell you what equipment is needed, its cost, and what it will accomplish for you.

Our stock includes **Air Compressors, All Kinds of Pumps, Filter Presses, Dryers, Hardinge Ball and Pebble Mills, Abbe Mills, Tube Mills, Mixers, Crushers, Elevators, Tanks, Motors, Engines, etc.**

When you buy used equipment insist on receiving a detailed report covering every part—we give it! Insist on a GUARANTEE of condition—we give it! Ask anybody, that has bought from us!

EDW. W. LAWLER, Metuchen, N. J.

Phone: Metuchen 245 L. V. R. R., E. Durham Ave.

Some Representative Items from our stock—

WRITE FOR PRICES.

Filter Presses

Shriver—24x24 iron.
Shriver—30x30 iron.
Shriver—42-in.x42-ft. wood Type B.
Johnson 24x24 iron.
Johnson 30x30
Sperry 30x30

Vacuum Filters

American with 12—6-ft. dia. discs. Complete with Pump and Receiver.

Vacuum Dryers

Size 34—a complete unit, shelf type.
Stokes Rotary 4x20-ft. Laboratory Dryers (2).
Buffalo 42x42x48.

Rotary Dryers

3x8-ft. 30-in.x30-ft. 4x30-ft. 3x25-ft. 6x100-ft. 6-ft. 6-in. x60-ft.

Mills

Krupp No. 8 Ball.
Hardinge 3-ft., 4½-ft., 5-ft., 8-ft. x 48-in. Ball.
Hardinge 5-ft., 8-ft. Pebble.
Allis-Chalmers 5x22-ft. Tube.
Smidth 5x22-ft. Tube.
Abbe 4-ft. 6-in.x12-ft. Tube.
Pebble Mill.
Abbe 24x36, 30x33, 36x42.
Patterson 6-ft.x5, 6x8-ft.
Acme 36x30, 36x44.
Crossley 6x8-ft. Roller Bearing.

Miscellaneous Mills

24-in. Cogswell, 24-in. Cage, 12-in. Cage.
33x42-in. Fuller.
J. B. Hammer.
Jeffery 30x24 Mill.
Chaser Mill 4-ft.x12-in. Stones.
Ross French Burr Stone 30-in.

Crushers

Gates D. & K.
Sturtevant 7x24, 9x15.
Allis-Chalmers 12x12.

Mixers

Gedge Gray 8 Bbl.
2—Werner & Pfleiderer.
Day D8.
Day 80 gal. change can.

Compressors

2—Nash Hytors No. 1 Direct connected.

Miscellaneous

Duriron Pumps 1½, 4-in.
Automatic Weigh Machines (new).
Sulphonator 4x5-ft.
Fusion Kettle 6x3-ft., 5-ft.x3-ft. 6-in.
Salt Filter 3-ft.x2-ft.6-in.
Vacuum Evaporator 3x12-ft.
Stills, 6x4-ft., 3-ft.6-in.x6-ft., 50 gal., 25 gal., all jacketed and complete units.
Norwalk Compressor 500 lbs., 175 cu. ft.
Laidlaw 1400, 600-ft., 840-ft.

Read This Testimonial

A recent purchaser wrote the following about a mill bought from us—"We are very much pleased with the mill and if appearances count we should have a crackerjack. Hope to have the pleasure of meeting you in Cleveland."

FOR SALE

FILTERS

2—No. 250 Kelly Filters.
2—No. 450 Kelly Filters.
1—6-ft., 4 leaf American.
1—6-ft., 8 leaf American.
1—5-ft.x6-ft. Oliver. Complete with pumps.
1—48 Retort, Caldwell Bone Black Kiln.
3—24x24, 30 plate, Sperry C. I. recessed presses
1—24x24, 40 plate, Sperry C. I. recessed press.
2—30x30, 36 plate, Sperry C. I. recessed presses
2—30x30, 30 plate, Shriver C. I. recessed presses
3—30x30, 36 plate, Shriver wood P & IF presses.
1—30x30, 50 chamber, Johnson P & F press.
1—36x36, 50 chamber, Sperry P & F press.
5—No. 1 Anderson Oil Expellers.
1—No. 1 Anderson Moisture Expeller.
1—No. 2 Anderson Moisture Expeller copper bar.
2—48-in. Tolhurst centrifugals, self balancing. Copper baskets.
4—Smith Vaile Hydraulic Cotton Seed Oil Presses.

E. E. NORRIS

140 S. Dearborn St., Chicago

TANK BARGAINS

25—30,000 gallon capacity, 20 ft. diameter, 12 ft. high, vertical, closed-top, flat bottom storage tanks, ⅛ and 5/16-in. plate. Price each, f.o.b. Hopewell, Virginia, $450.00.

Also other tanks and equipment.

WILSON-HOCK COMPANY
Hopewell, Virginia

FOR SALE

VACUUM DRYER

1—40x80-in. Devine Single Rotary Drum Vacuum Dryer with Jet Condenser in first class condition at attractive price.

FS-598 Chem. & Met. Engrg.
Tenth Ave. at 36th St., New York City

In the SEARCHLIGHT SECTION there is something of interest for Every Reader

Different Each Week

The business wants of concerns and individuals are varied and always changing. Each day brings new wants; each day finds others filled.

The SEARCHLIGHT SECTION

of this paper advertises the business wants of the organizations and men in this field. As their wants change, so do the "Searchlight" **ads**.

For Every Business Want
Think "SEARCHLIGHT" First

G-20

Eighty Pages of Bargains

in our new General Equipment Catalogue just off the press. Write for your copy. Catalogue covers equipment available at the immense Old Hickory Powder Plant and two other industrial plants which we are dismantling. Our equipment is in good condition, dependable, cheap, and available for prompt shipment. Most of it used less than three months.

EVAPORATORS

1—Zaremba Double Effect Evaporator, Class M, size 102 in. Includes 4 C. I. Salt Pots 4-ft. dia. x 5-ft. deep. 1 Barometric Condenser 4-ft.x8-ft. 6-in., 1 Zaremba Vacuum Pump No. 132899, size 14x18x 20-in.

1—Swenson Evaporator, 30¾-in. wide x4-ft. 9-in. long, 128 sq. ft. heating surface made up of 140 pieces of ¾-in.x48-in.x18-gauge Copper Tubes.

STILLS AND COLUMNS

1—W. E. Lummus Still, consisting of kettle, column, and condenser. Kettle 5-ft. dia.x7-ft. long, ⅛-in. steel plate. Column cast iron, 8 plates (8-ft. high), 42-in. dia., each plate fitted with 28 Lummus 2-in. boiling caps. Condenser 5-ft.6-in.x3-ft.x4-ft.8-in. deep, with 2-in. pipe coil and manifold, approximately 175 ft. pipe in coil.

1—Steel Still, 300 gal. capacity. Diameter 3-ft., length 6-ft. Shell is ⅝-in. plate, double lap riveted. Fitted with 10 passes 1½-in. pipe coil. 10-in. vapor outlet, 10-in.x14-in. manhead with crowfoot clamp, 6-in. washout, and all necessary gauge connections, inlets and outlets. Weight approx., 1,600 lbs.

1—J. P. Devine Beta Napthol Still, made up as follows: 1 cast iron still pot 5-ft. diameter x 6-ft. deep, made of high grade cast iron and arranged to be supported in brick furnace for direct fire, with cast iron dome shaped cover with flanged vapor outlet, manhole cover with clamps and connections; 1 condenser 6-in. dia. x 9-ft. long, jacketed for either steam or water with all connections welded; 2 receivers 2-ft.6-in. diameter x 5-ft. long, jacketed for either steam or water with hinged doors and swinging eye bolt. Glass observation ports in doors. Special two way valve on receivers, so that condenser can discharge into either receiver. 1 steel fractionating column, 18-in. square, 6-ft. high

6—Benzol Chlorinating Towers for the manufacture of Monochlorobenzol. Receiving pots are 5-ft. diameter x 5-ft. deep, with 2x2-ft. square towers, 15-ft. high mounted on opening in cover. Towers made up of ten sections, each 1-ft.6-in. high, bolted together. Pots have bolted covers and supported on cast iron legs.

2—W. L. Lummus Stills, for light oils, complete with:
2—Horizontal Steel Stills, 8-ft. diameter x 8-ft. long, 5/16-in. plate, double riveted lap. Each still has 18-in. x 14-in. manhead in end. 6-in. vapor connection in top and necessary inlet; drain and gauge connections. Coils consist of 18 turns 1½-in. pipe, 7-ft. long.
3—Lummus Steel Plate Columns, 4-ft. diameter, made up of base section 4-ft. high, 8 intermediate sections, each section with 2 plates with 8-6-in. boiling caps on each plate. On top of 2 towers there are 32-in. rectangular cast iron 6-section reflux condensers or dephlegmators.
2—Jet Condensers 8-in.x12-in. with 2-in. water or steam connections, 3-in. vapor connections, and 4-1-in. draw off valves.
3—Open Top Steel Tank Condensers with 2-in. pipe coil.
1—Vertical Closed Top Steel Feed Tank, 7-ft. dia. x 4-ft. deep, ¼-in. plate. Has 2—14-in. manheads in top and 1—2-in. pipe connection. 1—2-in. draw off in bottom. One seamless steel ring with bolted top and bottom. Capacity 1,200 gal. Weight, 1,700 lbs.

2—Pfaudler Vertical Closed Steel Stills, 9-ft. x 8-ft. high, ⅜-in. plate, with ⅛-in. bottom. One seamless ring with bolted top and bottom, and equipped with 9 turns 2½-in. W. I. pipe coil. Openings in top, 1—14-in. manhead, 1—2-in., 1—6-in.; in bottom, 1—2½-in. and 1—3-in. Capacity, 3,800 gal. Weight, including coil, 7,000 lbs.

ACID PROOF CHEMICAL STONEWARE
(all new)

78—No. 14-D-82 Bell and Socket Pipe, 6-in. dia. x 3-ft.9-in. long.
46—No. 2605 A Bell and Socket Pipe, 6-in. dia. x 18-in. long.
7—No. 14M82—8-in. Elbows.
15—No. 14M118—8-in. Elbows.
6—No. 14D118—6-in. Elbows.
7—No. 14J82—6-in. U-Bends.
75—No. 212A—8-in. Return Bends 2-ft.8½-in. long.
38—No. 212C—6-in. Return Bends 5-ft.3-in. long.
16—No. 14-F-77-6-in. U-Bends.
35—No. 834-A 3x3x3-in. Tees, 24-in. long.
8—No. 834-C-6x6x4-in. Tees, 3-ft. 1-in. long.
25—No. 14-F-82-8x8x6-in. Tees, 5-ft. 10-in. long.
63—No. 14A 75 5-in. Manifolds, 7 outlet.
65—No. 14B75 8-in. Manifolds, 7 outlet.
14—No. 14A76 8-in. Manifolds, 6 outlet.
66—No. 14B76 8-in. Manifolds, 5 outlet.
36—No. 14D76 8-in. Manifolds, 6 outlet.
82—No. 14C76 8-in. Manifolds, 3 outlet.
30—No. 14F76 8-in. Manifolds, 3 outlet.
22—No. 14F50 Trap inlets.
26—No. 14G50 Trap bodies.
75—No. 14 W 69 Pots. Lids and covers, etc.
80—No. 2145A Distributors.
50,000—No. 973A 4x3 Packing Rings.
164—No. 14E75 Saucers.

Write for complete list in General Equipment Catalog.

DURIRON, TANTIRON AND CORROSIRON CASTINGS

10—No. 1213 C 24-in. Bleacher Bottom Sections, Duriron and Tantiron, Covers, etc.
30—No. 3160A 8-in. Manifolds, 7 outlet, Duriron and Corrosiron.
8—No. 10929A—8-in. Manifolds, 7 outlet, Tantiron.
75—No. 14D 8-in. Manifolds, 7 outlet, Duriron.
6—No. 10260A1 8-in.x14-in. Duriron Increasers.

Also pipe and fittings, bends and elbows, tees, etc.

GLASSWARE

3,000—No. 14AN59 Hart condenser tubes, 3-in.x6-ft.4-in.
1,500—No. 14AN59 Hart condenser tubes, 3-in.x6-ft.4-in. Genuine Pyrex glass. Bends, Traps, etc.

Our new General Equipment Catalog gives complete list of this equipment.

LABORATORY EQUIPMENT

7—Alberene Stone Sinks 48-in.x24-in.x8-in. with pipe frame.
2—Henry Troemmer Acid Balances, agate bearings, 8-in. beam, capacity 200 grams.
4—Stokes Dryers No. 51 with condensers, cast iron walls.

COPPER DISTILLING EQUIPMENT

7—Alcohol Condensers 35-in. dia., 8-ft.9½-in. high.
12—Alcohol Dephlegmators, 37½-in. dia., 8-ft.3½-in. high.
4—Ether Columns 44-in. dia. x 5-ft. 6-in. high.
2—Ether Condensers 41-in. dia. x 9-ft.4¾-in. high.

NITRATORS

2—Special 7,000 lb. Buffalo Nitrators, consisting of steel tank and stirring apparatus.
1—Bethlehem Cast Iron Nitrator 4-ft. dia. x 7-ft. high, steam jacketed, capacity 675 gallons. Working pressure, 75 lbs.
6—Bethlehem Cast Iron Nitrators, 6-ft. dia. x 11-ft. high, steam jacketed with riveted steel shell running within 4-ft. of top. Working pressure 75 lbs.

THERMOMETERS

6—Different types of thermometers for chemical plant use. Write for catalog.

REDUCERS

4—Buffalo Standard Reducers, 6-ft. 4-in. dia. x 8-ft. high.
12—Buffalo Aniline Reducers 6-ft. dia. x 8-ft. deep.

FILTER PRESSES

1—18-in. Sperry Iron Type Sperry Filter Press.
5—30-in. Sperry Type CS Filter Presses. Additional plates and frames.

MIXERS

5—F. J. Stokes Mixers, cast iron trough, 5-ft.x3-ft.x4-ft. with steel steam or water jacket. Sigma blades, pulley and gear drive.

POWER HOUSE EQUIPMENT

9—823 HP. Babcock & Wilcox Stirling water tube boilers. Class M-30, 200 lbs. pressure. Westinghouse stokers and all accessories.
2—300 HP. Heine Water Tube Boilers.
6—400 HP. Wickes Vertical Water Tube Boilers, Murphy Stokers.
1—300 HP. Vogt Water Tube Boilers.

OIL REFINERY EQUIPMENT

1—Lead Lined Acid Agitator, 10-ft.6-in. dia. x 27-ft.6-in. high over all, with cone bottom.
2—Standard type Refinery Stills, 10-ft.6-in. dia. x 36-ft. long.
2—Open top steel plate Condenser Boxes, 32-ft. long, 10-ft. wide, 8-ft. deep.

Oil Refinery Equipment includes a complete plant.

STEEL TANKS

A large stock of steel tanks in a wide variety of sizes, patterns, and makes. Tanks for storage, stirring, agitating, mixing, pressure, etc.

PUMPS

Large stock of centrifugal, steam, hydraulic, acid, etc., pumps.

You will find our new General Equipment Catalog full of bargains in a wide variety of lines. Write for it.

Nashville Industrial Corporation, Old Hickory, Tennessee

Here is an opportunity for

a chemical or mechanical engineer who has had at least three to five years' experience in plant work in the chemical engineering industries. This young man should like to write, and preferably have had some experience in gathering statistics and making detailed reports. If you know such a person you'll be doing him, and us, a favor by having him write to

Chemical and Metallurgical Engineering
Tenth Avenue at 36th Street, New York
Attention, Business Manager

Today's Prices Are Highest

Let "Searchlight" Help You

The quicker idle equipment is sold, the higher the selling price it can demand—today's prices are always highest because—

Equipment permitted to remain unused depreciates rapidly and occupies valuable space. Every day of idleness brings down the possible selling price.

"Searchlight" Locates Quick Buyers

The wise owner of idle equipment promptly informs the field of his desire to sell through an advertisement in the Searchlight Section, where he knows that those who might need what he has will be most likely to look first.

The Right Wood in the Right Tank Will Solve Your Problem

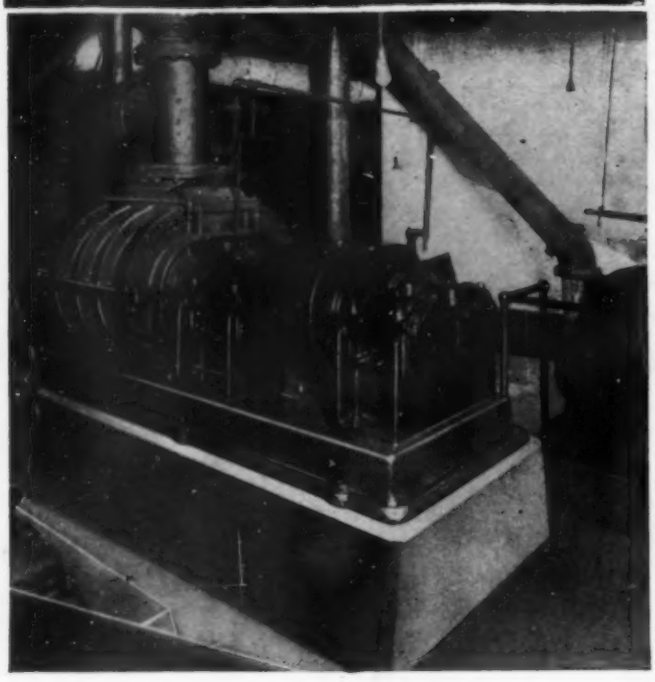
Send for Treatise!

Our research department has conducted a series of experiments to determine the relative resistance of different woods to the action of well-known chemicals in various strengths, at room temperature and at 100 degrees centigrade or above. The results of these experiments have been embodied in a treatise which will be of interest and value to every user of wood tanks. This treatise also illustrates wood tanks for every purpose.

We shall be glad to send you a copy of this treatise. Write NOW! No obligation involved.

The Hauser-Stander Tank Co.

Cincinnati, O.



ROOTS

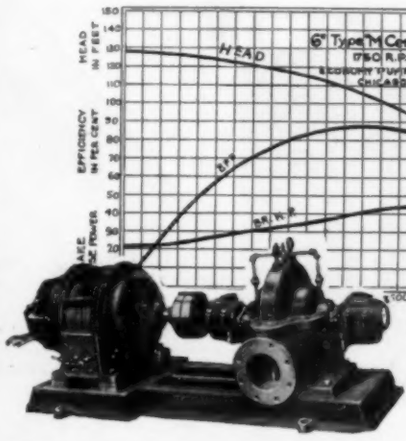
Rotary Pumps

Roots Vacuum Pumps are used throughout the chemical industry for low pressure evaporation, gathering of still vapors and the handling of volatile liquids. There are many of them in use on fatty acid stills, maintaining vacuums as high as 25″.

Since 1859—the Roots principle of rotary pumps and blowers has been considered *standard*. Since 1859, Roots pumps have been constantly improved in the detail of their design, but the same principle of a tangent arc impeller still remains unchanged.

Ask for Bulletin No. 1141—It gives complete specifications of vacuum pumps from .009 c. f. per revolution to 1200 c. f. per revolution.

The P.H.&F.M. ROOTS CO.
DEPT. 10
CONNERSVILLE, IND.
Chicago Office 130 S. Michigan Ave. *New York Office* Room 800-120 Liberty St.



Type M

What would 23% saving mean to you?

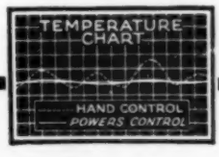
Certainly a very tidy sum to be cut from your pumbing costs by the use of Economy High Efficiency Pumps. The curve shown represents the performance of a standard 6-in. Single Stage Centrifugal Pump, taken from stock, and not a special unit prepared for developing the best results. It shows an efficiency of 87% when pumping 1,300 G.P.M. at 105 ft. head.

We make single or multi-stage horizontal split case pumps. May we send you a catalog?

ECONOMY PUMPING MACHINERY CO.
101 North Curtis St., Chicago, Ill.

ECONOMY PUMPS

(3431)



REGULATORS to control temperatures of Liquids, Gases and Air in Industrial Processes. ¶ Thermostatic Regulators to control the mixing of Hot and Cold Air, Hot and Cold Water, Steam and Cold Water, to deliver a mixture at any temperature desired. ¶ High Pressure Steam Traps, Dial Indicating Thermometers. ¶ Systems of Temperature and Humidity Control for Offices, Work-rooms, and Process Rooms.

THE POWERS REGULATOR CO.

35 years of specialization in temperature control

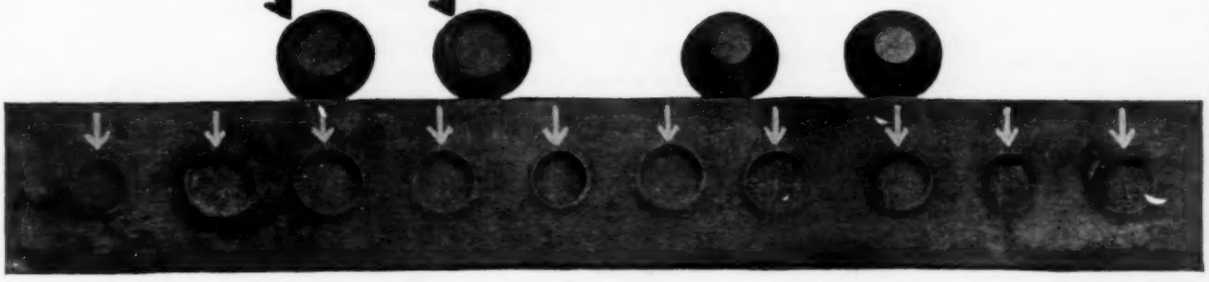
2727 Greenview Ave., Chicago. Also New York, Boston, Toronto and 31 other offices. See your telephone directory.

Facts Talk No 3

TWO PIECES OF HALF INCH BOILER PLATE SPOT WELDED TOGETHER

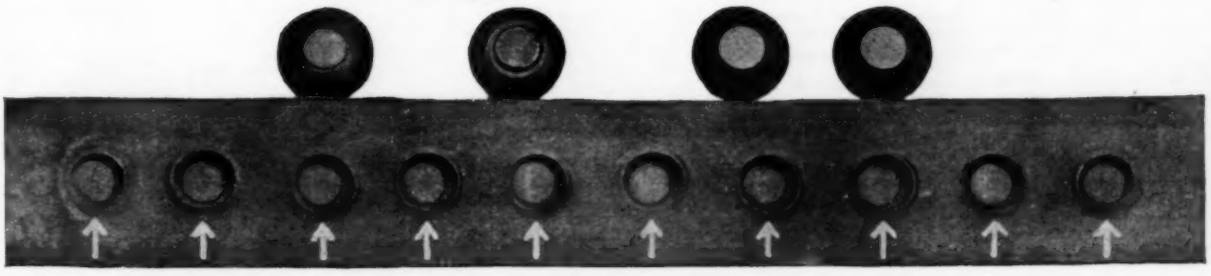
① With Copper Electrodes

MUSHROOMS AT TIP



② With Elkonite Electrodes

PERFECT WELDS



Constant Hardness and Stability Under Red Heat

ELKONITE WELDING ELECTRODES remain hard, hold their shape under red heat and the high pressures and electric currents common to resistance welding. They maintain a constant hardness under the most difficult service conditions.

These qualities are common to all Elkonite Welding Electrodes. Other characteristics of the Elkonite series may be varied to meet special conditions which present themselves in resistance welding.

If you are having trouble with hard drawn copper let our laboratory staff advise with you

ELKON WORKS Inc.
Subsidiary of P. R. Mallory & Co. Inc.
Weehawken, N. J.

ELKONITE
has made the spot welding of
ALUMINUM
BRASS
TINNED IRON
GALVANIZED IRON
commercially practical for the first time.

Exclusive licensees under General Electric Co. patents dated May 26, 1925 and Sept. 1, 1925.
Other patents pending to Elkon Works, Inc.

WHAT AND WHERE TO BUY

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Chemical and Metallurgical Engineering* assumes no responsibility for errors or omissions.
For alphabetical index see last page.

Abrasives
American Tripole Co.
Carborundum Co.
Norton Co.

Accumulators, Steam
Ruths Accumulator Co.

Acetic Ether
U. S. Industrial Chem. Co.

Acetoacetic Ester
U. S. Industrial Chem. Co.

Acetone
Commercial Solvents, Acetylene Dissolved.
Prest-O-Lite Co.

Acetylene Compressor
International Oxygen Co.

Acetylene, Dissolved
Prest-O-Lite Co.

Acids
General Chemical Co.

Acid Concentration Apparatus
Chemical Construction Co.
Thermal Syndicate, Ltd.

Acid Plants, Hydrochloric, Nitric Sulphuric, etc.
Chemical Appliances, Inc.
Chemical Construction Co.
Thermal Syndicate

Acid Proof Chemical Stoneware
(See Chemical Stoneware, Acid Proof)

Acid Resisting Metal (Bars, Sheets, Rods, etc.)
Alcumite Corp'n
Allegheny Steel Co.

Agitators
Bartlett & Snow Co.
Buffalo Fdy. & Machine Co.
Dorr Co.
Manitowoc Engrg. Works
Mixing Equipment Co.
Patterson Fdy. & Machine Co.
Sowers Mfg. Co.

Air Conditioning and Purifying Apparatus
American Blower Co.
Buffalo Forge Co.
Hardinge Co.
Holly Pneumatic Systems, Inc.
Parks-Cramer Co.

Air Lifts
Beach-Russ Co.
Chicago Pneumatic Tool Co.
The Norwalk Co.
Sullivan Machinery Co.

Air Meters
(See Meters, Flow, Air, Etc.)

Air Separators
(See Separators, Air, Gas)

Alcohols
Commercial Solvents Corp.

Alcohols, Amyl, Butyl, Ethyl, etc.
Industrial Chemical Co.
U. S. Industrial Chem. Co.

Alkalies
Diamond Alkali Co.
Pennsylvania Salt Mfg. Co.

Alloys, Acid Proof
Elkon Works, Inc.

Alloys, Ferrous
Allegheny Steel Co.
Central Steel Co.
Electro Metallurgical Sales Corp'n
Ludlum Steel Co.
Metal & Thermit Corp'n
Timken Roller earing Co.

Alloys, Non-Ferrous
Aluminum Co. of America
American Nickel Corp'n
American Platinum Wks.
Baker Platinum Works
Copper & Brass Research Assn.
Driver-Harris Co.
Electro Metallurgical Sales Corp'n
Elkon Wks., Inc.
Fansteel Products Co.
Hoskins Mfg. Co.
Hybinette, Victor
Metal & Thermit Corpn.

Alloys, Steel
(See Alloys, Ferrous)

Aluminum
Aluminum Co. of America

Alums
General Chemical Co.

Ammeters
(See Instruments, Testing)

Amyl Acetate
U. S. Industrial Chem. Co.
Co.

Aprons
Chemical Rubber Co.

Ash Handling Machinery
Bartlett & Snow Co.
Combustion Engineering Corp'n
Holly Pneumatic Systems, Inc.
International Combustion Engrg. Corp'n
Jeffrey Mfg. Co.
Republic Flow Meters Co.
Standard Conveyor Co.
Webster Mfg. Co.

Autoclaves
Bethlehem Fdy. & Machine Co.
Buffalo Dental Mfg. Co.
Buffalo Foundry & Machine Co.
Chemical & Vacuum Machinery Co.
Devine Co., J. P.
Sargent, E. H., & Co.

Automatic Feed Control
Leeds & Northrup Co.

Automatic Temperature Control
Amer. Schaeffer & Budenberg Corp'n.
Bailey Meter Co.
Bristol Co.
Brown Instrument Co.
Engelhard, Charles, Inc.
Fulton Co.
Leeds & Northrup Co.
Moto Meter Co.
Powers Regulator Co.

Bagging Material
Chase Bag Co.

Bags, Waterproof
Chase Bag Co.

Balances & Weights
Chemical Rubber Co.
Fisher Scientific Co.

Barrels, Wood
Atlantic Tank & Barrel Corp'n

Baskets, Dipping (incl. Monel Metal and Nickel)
Buffalo Wire Wks.
Cleveland Wire Cloth & Mfg. Co.
Jelliff Mfg. Corpn., C. O.
Multi-Metal Co.
Newark Wire Cloth Co.

Bearings, Tapered, Thrust, Roller
Timken Roller Bearing Co.

Belt Conveyors
(See Conveying Mach.)

Belting
Cincinnati Rubber Mfg. Co.
Goodrich Rubber Co., B. F.
Morse Chain Co.
U. S. Rubber Co.

Blast Gates
Rockwell Co., W. S.

Blowers, Fan, Rotary, Positive and Turbine
American Blower Co.
Beach-Russ Co.
Buffalo Dental Mfg. Co.
Buffalo Forge Co.
The Connersville Blower Co.
De Laval Steam urbine Co.
Duriron Co.
Jeffrey Mfg. Co.
Roots Co., P. H. & F. M.

Boiler Covering & Insulation
Armstrong Cork & Insulation Co.
Celite Products Co.
Johns-Manville, Inc.

Boiler Meters
(See Meters, Flow, Air, Etc.)

Boiler Settings
Chemical Appliances, Inc.
Custodis Chimney Co.

Boiler Tubes & Fittings
Todd Dry Dock, Engineering & Repair Corp'n

Boilers
Babcock & Wilcox Co.
Erie City Iron Works
Southwestern Engineering Corp.
Manitowoc Engrg. Works

Bolting Cloth, Silk
Abbe, Paul O.
Simpson Co., The Orville

Bolts & Nuts
International Nickel Co.

Books, Technical
Chemical Catalog, Inc.
McGraw-Hill Book Co.

Bottling Machinery
Kiefer Machine Co., Karl

Brass
Copper & Brass Research Ass'n.

Brick and Clay Acid Proof
General Ceramics Co.
Knight, M. A.

Brick, Insulating
Armstrong Cork & Insulation Co.
Carborundum Co.
Celite Products Co.
Dixon Crucible Co.
Johns-Manville, Inc.

Brick Refractory (Chrome, Magnesia, Silica, Silicon Carbide, Fused Alumina, etc.)
Bartley Crucible Co.
Carborundum Co.
General Refractories Co.
Norton Co.

Brimstone
Texas Gulf Sulphur Co.

Bronze
Copper & Brass Research Corp'n

Bucket Elevators
Bartlett & Snow Co.
Hendricks Mfg. Co.
Jeffrey Mfg. Co.
Webster Mfg. Co.

Buckets, Elevator
Hendrick Mfg. Co.

Buckets and Pails, Acid Resisting
Koven & Bros., L. O.

Building Materials
Robertson Co., H. H.

Burners, Gas, Oil, Powdered Coal
Best Corporation, W. N.
Chicago Pneumatic Tool Co.
Kemp Manufacturing Co.
Mettler Co., Lee B.

Butanol
Commercial Solvents Corp.

Butyl Alcohol (Normal)
Commercial Solvents Corp.

Cabinets, Chemical, Filing, and Laboratory
Kewaunee Mfg. Co.
Peterson & Co., Inc., Leonard

Calciners
Bartlett & Snow Co., C. O.
Ruggles Coles Eng. Co.

Calorimeters
Bausch & Lomb Optical Co.
Carbon Dioxide Gas C.O.2
Liquid Carbonic Co.

Carbon, Gas Recovery, Decolorizing
American Solvent Recovery Corp.
Barnebey-Cheney Engrg. Co.
Darco Sales Corp'n
Industrial Chemical Co.

Car Tanks, Wood
Hauser-Stander Tank Co
Woolford Wood Tank Co.

Cars, Tank, Steel
Pfaudler Co.

Casseroles
Engelhard, Charles, Inc.

Castings, Acid Proof
Alcumite Corp'n
Allegheny Steel Co.
Aluminum Co. of America
Bethlehem Fdy. & Machine Co.
Duriron Co.
International Nickel Co.
Pacific Foundry Co.
Standard Calorimeter Co.
U. S. Cast Iron Pipe & Fdy. Co.

Castings, Heat Resisting
Allegheny Steel Co.
Hybinette, Victor
International Nickel Co.

Castings, Iron
Buffalo Foundry & Machine Co.
Chemical & Vacuum Machinery Co.
Erie City Iron Works
Hardinge Co.
Jeffrey Mfg. Co.
McGann Manufacturing Co.
Timken Roller Bearing Co.
Vulcan Iron Works

Castings, Monel Metal
Chemical & Vacuum Machinery Co.
International Nickel Co.

Castings, Semi-Steel
Buffalo Fdv. & Machine Co. Co.

Castings, Special
Alcumite Corp'n
Allegheny Steel Co.
Driver-Harris Co.
Erie City Iron Works
International Nickel Co.
Timken Roller Bearing Co.

Caustic Pots
Bethlehem Fdy. & Machine Co.
Buffalo Foundry & Machine Co.
Chemical & Vacuum Machinery Co.

Caustic Soda
Diamond Alkali Co.

Cement, Acid Proof
Chemical Appliances, Inc.
Chemical Construction Co.
General Ceramics Co.
Knight, M. A.

Cement, Insulating
Armstrong Cork & Insulation Co.
Bakelite Corp.
Carborundum Co.
Celite Products Co.
Dixon Crucible Co.
Johns-Manville, Inc.
Norton Co.

Cement, Refractory
Carborundum Co.
Celite Products Co.
Johns-Manville, Inc.
Norton Co.

Centrifugals
American Tool & Machine Co.
Fletcher Works
Tolhurst Machine Works

Chain Drives
Morse Chain Co.

Chemical, Plant Equipment
Badger & Sons Co., E. B.
Buffalo Fdry. & Mch.
Chemical Appliances, Inc.
Swenson Evaporator Co.

Chemical Stoneware, Acid Proof
Chlorine Generators, Coils or Worms, Valves and Fittings, Crystallizing Pans, Receivers or Woulff Jugs, Cocks, Tower Parts and Pitchers and Funnels, Storage and Decanting Jars, Ejectors, Cellarius Tourills, Jugs and Pots, Condensing Pipe, Chamotte or Sleeve Pipe.
Chemical Appliances, Inc.
General Ceramics Co.
Knight, Maurice A.
U. S. Stoneware Co.

Chemicals, Industrial
Arnold, Hoffman & Co.
Carbide & Carbon Chemicals Corp.
Commercial Solvent Corp'n
Denver Fire Clay Co.
Dow Chemical Co.
General Chemical Co.
Industrial Chemical Co.
King Chemical Co.
Miner Laboratories
Pennsylvania Salt Mfg. Co.
Sargent, E. H., & Co.
U. S. Industrial Chem. Co.

Chemicals, Laboratory
Carbide & Carbon Chemicals Corp.
Commercial Solvent Corp'n
General Chemical Co.
Merck & Co.
Miner Laboratories
Pennsylvania Salt Mfg. Co.
U. S. Industrial Chem. Co.

Chimney Repairs
Custodis Chimney Co., Alphons

Chimneys, Acid Proof, Radial Brick
Chemical Appliances, Inc.
Custodis Chimney Co., Alphons

Chromium Plating
Chemical Treatment Co.
Chromium Products Corp'n

Clarifiers
Dorr Co.
Hardinge Co.
United Filters Corp'n

Classifiers
Dorr Co.
Hardinge Co.

Coal Meters
(See Meters, Flow, Air, etc.)

Coal Storage Systems
Bartlett & Snow Co.
Jeffrey Mfg. Co.
Standard Conveyor Co.
Wellman-Seaver-Morgan Co.

Coatings
(Acid Resistant, Aluminum, Brass, Bronze, Copper, Iron Lead, Monel Metal, Nickel, Tin, Zinc)
Metals Coatng Co. of America

Cocks and Bibbs
(See Pipe and Fittings)

Coils and Bends
Albright, Son & Co.
Aluminum Co. of America
Lead Lined Iron Pipe Co.
Resisto Pipe & Valve Co.

Combustion Boats
Engelhard, Charles, Inc.
Norton Co.

Concrete Admixtures
Celite Products Co.

Compressors, Air or Gas
Beach-Russ Co.
Chicago Pneumatic Tool Co.
General Electric Co.
The Norwalk Co.
Powers Regulator Co.
Sullivan Machinery Co.
Trimont Rotary Power Co.
Worthington Pump & Mch. Corp'n

Aluminum

equipment

Vinegar
Citric Acid
Tartaric Acid
Gelatin
Paper
Rubber
Formaldehyde
Varnishes
Alcohols
Sugar
Rayon

The salts of aluminum are harmless and colorless

Aluminum Company of America, 2400 Oliver Bldg., Pittsburgh, Pa

ALUMINUM in EVERY COMMERCIAL FORM

Write for Copy of this Illustrated Booklet

Condensers, Barometric Surface or Jet
Buffalo Forge Co.
Buffalo Fdy. & Machine Co.
Chemical & Vacuum Machinery Co.
Chicago Pneumatic Tool Co.
Devine Co., J. P.
New York Engineering Co.
Southwestern Engineering Corp'n
Swenson Evaporator Co.
Westinghouse Electric & Mfg. Co.
Worthington Pump & Mch. Corp.

Containers
Chase Bag Co.
Driver-Harris Co.
Glascote Co.
Hoskins Mfg. Co.
Hybinette, Victor
Koven & Bro., L. O.

Controllers, Temperature, Pressure, Humidity, etc.
American Schaeffer & Budenberg Corp'n
Bristol Company, The
Brown Instrument Co.
Engelhard, Charles, Inc.
Fulton Co.
Leeds & Northrup Co.
Mason Regulator Co.
Moto-Meter Co.
Powers Regulator Co

Conveying Machinery and Equipment
Bartlett & Snow Co., C. O.
Cincinnati Rubber Mfg. Co.
Goodrich Rubber Co., B. F.
Gruendler Patent Crusher & Pulverizer Co.
Holly Pneumatic Systems, Inc.
Jeffrey Mfg. Co.
Kiefer Machine Co., Karl
Standard Conveyor Co.
Stearns Conveyor Co.
Sturtevant Mill Co.
U. S. Rubber Co.
Webster Mfg. Co.
Wellman-Seaver-Morgan Co.

Coolers
Badger & Sons Co., E. B.
Chicago Pneumatic Tool Co.
Hardinge Co.
Southwestern Engineering Corp'n.

Copper
Copper & Brass Research Ass'n

Coppersmithing
Badger & Sons Co., E. B.
Buffalo Fdy. & Machine Co.

Crucibles, Industrial
Bartley Crucible Co.
Dixon Crucible Co.
Thermal Syndicate, Ltd.

Crucibles, Laboratory
Amer. Platinum Works
Baker Platinum Works
Engelhard, Charles, Inc.
Thermal Syndicate, Ltd.

Crushers, Grinding Mills & Pulverizers
(See Machinery, Crushing, Grinding and Pulverizing)

Crushers, Laboratory
Braun Corp'n
Chemical Rubber Co.

Crystallizing Equipment
Buffalo Fdy. & Machine Co.
Glascote Co.
Devine Co., J. P.
New York Engineering Co.
Pfaudler Co.
Sowers Mfg. Co.
Swenson Evaporatory Co.
Zaremba Co.

Cutting Apparatus
International Oxygen Co.

Dehydrators, Centrifugal
(See Centrifugals)

Designing Engineers, Chemical Plant
Chemical Appliances, Inc.

Diacetone Alcohol
Commercial Solvents Corp.

Dibutyl Phthalate
Commercial Solvents

Disintegrators
Abbe, Paul O.
Abbe Engineering Co.
Bartlett & Snow Co.
Day, J. H., Co.
Gruendler Patent Crusher & Pulverizer Co.
Jacoby, Henry E.
Jeffrey Mfg. Co.
Kottler & Son, W.

Distilling Machinery & App.
Barnstead Still & Sterilizer Co.
Devine Co., J. P.
Precision Scientific Co.
Ruggles-Coles Eng. Co.
Williams Patent Crusher & Pulv. Co.

Drives, Chain
Jeffrey Mfg. Co.
Morse Chain Co.

Dry Rendering Equipment
California Press Mfg. Co.

Dryers, Centrifugal
American Tool & Machine Co.
Fletcher Works
Swenson Evaporator Co
Tolhurst Machine Works

Drying Machinery and Equipment, Drum, Rotary, Vacuum
Bartlett & Snow Co., C. O.
Buffalo Fdry. & Mch. Co.
California Press Mfg. Co.
Chemical & Vacuum Machinery Co.
Devine Co., J. P.
Erie City Iron Works
Filtration Engineers, Inc.
Fulton Co.
Louisville Drying Machinery Co.
Manitowoc Engrg. Works
McGann Manufacturing Co.
New York Engineering Co.
Phila. Drying Mach. Co.
Proctor & Schwartz, Inc.
Scott & Co., Ernest
Shriver & Co., T.
Spray Dryer Process Corp.
Stokes Machine Co., F. J.
Swenson Evaporator Co.
Thermo Electric Instrument Co.
Vulcan Iron Works

Dust Collecting Systems & Engineers
Allis-Chalmers Mfg. Co.
Dust Recovering & Conveying Co.
Erie City Iron Works
Hardinge Co.
Holly Pneumatic System, Inc.
Raymond Bros. Impact Pulv. Co.

Dynamos
Westinghouse Electric & Mfg. Co.

Earthenware, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Electrical Resistance Material
Driver-Harris Co.
Hoskins Mfg. Co.

Electrical Resistors
Driver-Harris Co.
Hoskins Mfg. Co.

Electrical Supplies
General Electric Co.
Johns-Manville, Inc.
Westinghouse Electric & Mfg. Co.

Electrolytic Cells
International Oxygen Co.
Shriver & Co.

Electroplating Salts
U. S. Industrial Chem. Co.

Enameled Apparatus, Acid Resisting
Chemical & Vacuum Machinery Co.
Glascote Co.
Pfaudler Co.

Enamels
Bakelite Corp.

Engineers, Consulting (Chemical, Analytical, Metallurgical)
Dorr Co.
Filtration Engineers, Inc.
Research Corpn.
Southwestern Engineering Corp.
(See Professional Directory)

Engineers, Furnace
Mettler & Co., Lee B.
Rockwell Co., W. S.
Surface Combustion Co.
Wellman-Seaver-Morgan Co.

Engines, Gas, Gasoline, Oil & Steam
Chicago Pneumatic Tool Co.
Erie City Iron Works
Fairbanks, Morse & Co.
Worthington Pump & Mch. Corp'n

Ethyl Acetate
U. S. Industrial Chem. Co.

Evaporators
Buffalo Fdry. & Mch. Co.
Chemical & Vacuum Machinery Co.
Devine Co., J. P.
Glascote Co.
Louisville Drying Machinery Co.
Manitowoc Engrg. Works
New York Engineering Co.
Pfaudler Co.
Scott & Co., Ernest
Southwestern Engineering Corp.
Swenson Evaporator Co.
Zaremba Co.

Exhausters, Rotary Positive Gas
Beach-Russ Co.
Buffalo Forge Co.
The Connersville Blower Co.
Chicago Pneumatic Tool Co.
Roots Co.

Expansion Joints
E. B. Badger & Sons Co.

Extraction Plants
American Tool & Machine Co.
Bartlett & Snow Co.
Buffalo Foundry & Machine Co.
Chemical & Vacuum Machinery Co.
Devine Co., J. P.
Fletcher Works
New York Engineering Co.
Scott & Co., Ernest
Tolhurst Machine Works

Fans, Standard & Acid Proof
American Blower Co.
Buffalo Forge Co.
Gross Lead Burning & Coating Co.
Phila. Drying Mchy. Co.
Raymond Bros. Impt. Pulv. Co.
Westinghouse Electric & Mfg. Co.

Faucets, Valves and Cocks, Stoneware, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Feeders
Jeffrey Mfg. Co.
Schaffer Poidmeter Co.
Standard Conveyor Co.

Ferro Alloys
(See Alloys, Ferrous)

Fillers
American Tripoli Co.

Filling Machinery
Kiefer Machine Co., Karl

Filter Aids
Celite Products Co.
Darco Sales Corp'n
Engelhard, Charles, Inc.
Palo Co.
Sargent & Co., E. H.

Filters, Air
Holly Pneumatic Systems, Inc.

Filter Cloth, Metallic
Buffalo Wire Wks.
Cleveland Wire Cloth & Mfg. Corp.
Jelliff Mfg. Corpn., C. O.
Ludlow-Saylor Wire Co.
Multi-Metal Co.
Newark Wire Cloth Co.
United Filters Corp'n
Wickwire-Spencer Steel Corp'n

Filter Cloth, Textile
Ludlow-Saylor Wire Co.
Shriver & Co., T.
United Filters Corp'n

Filter Paper and Mass
Angel & Co., H. Reeve
Johns-Manville, Inc.

Filter Press Plates, Iron, Wood
Hauser-Stander Tank Co.
Patterson Fdy. & Machine Co.
Perrin & Co., Wm. R.
Sperry & Co., D. R.
United Filters Corp'n

Filter Presses
Oliver Continuous Filter Co.
Patterson Fdy. & Machine Co.
Perrin & Co., Wm. R.
Shriver, T. & Co.
Sperry & Co., D. R.
United Filters Corp'n

Filter Presses, Laboratory
Perrin & Co., Wm. R.
United Filters Corp'n

Filter Presses, Monel Metal
Oliver Continuous Filter Co.
United Filters Corp'n

Filters, Air
Holly Pneumatic System, Inc.

Filters, Clarifying
Kiefer Machine Co., Karl

Filters, Rotary
Filtration Engineers, Inc.
Louisville Drying Machinery Co.
Oliver Filter Co.
United Filters Corp'n

Filters, Suction, Acid Proof
Knight, Maurice A.
Oliver Continuous Filter Co.
United Filters Corp'n
U. S. Stoneware Co.

Fire Clay
Armstrong Cork & Insulation Co.
Carborundum Co.
Celite Products Co.
General Refractories Co.
Norton Co.

Floor Hardening Compounds
General Chemical Co.

Flooring, Industrial, Ventilating, Fireproof, Non-Slipping
Hendrick Mfg. Co.
Irving Iron Works Co.
Johns-Manville, Inc.

Forgings, Monel Metal
Chemical & Vacuum Machy. Co.
International Nickel Co.

Furfural
Miner Laboratories

Furnaces, Electric
Combustion Engineering Corp'n
General Electric Co.
Hevi-Duty Electric Co.
Hoskins Mfg. Co.
International Combustion Engineering Corp'n
Leeds & Northrup Co.
Rockwell Co., W. S.

Furnace Insulation
Armstrong Cork & Insulation Co.
Bartley Crucible Co.
Carborundum Co.
Celite Products Co.
Dixon Crucible Co.

Furnaces & Accessories, Industrial (Assay Melting, Caustic Pots, Electric, Heat Treating, Oil Gas & Coke, Muffle, Porcelain-Enameling, Roasting, and Smelting)
Allis-Chalmers Mfg. Co
Best Corporation, W. N.
Braun Corporation
Braun-Knecht-Heimann Co.
Buffalo Dental Mfg. Co.
Combustion Engineering Corp'n
Denver Fire Clay Co.
Engelhard, Charles, Inc.
Hevi-Duty Electric Co.
Hoskins Mfg. Co.
International Combustion Engineering Corp'n
Palo Co.
Rockwell Co., W. S.
Sargent, E. H., & Co.
Surface Combustion Co.
Westinghouse Electric & Mfg. Co.

Fusel Oil
U. S. Industrial Chem. Co.

Gages, Recording and Indicating, Pressure, Vacuum and Liquid Level
Amer. Schaffer & Budenberg Corp.
Bailey Meter Co.
Bristol Company
Brown Instrument Co.
Moto-Meter Co.

Galvanizing
Metals Coating Co. of Amer.

Gas Analysis Instruments
Brown Instrument Co.
Leeds & Northrup Co.

Gas Holders
Stacey Bros. Gas Construction Co.

Gas, Nitrogen & Oxygen
International Oxygen Co.

Gas Plant Equipment
New York Engineering Co.
Stacey Bros. Gas Construction Co.

Gas Producers
Morgan Construction Co.
Smith Gas Engrg. Co.
U. G. I. Contracting Co.
Wellman-Seaver-Morgan Co.

Gaskets & Packing Rings
Garlock Packing Co
Johns-Manville, Inc.
U. S. Rubber Co.

Gears
Cleveland Worm & Gear Co.

Gears, Compensating, Herringbone, Worm, etc.
Jeffrey Mfg. Co.
Moore Steam Turbine Co.
Philadelphia Gear Works
Vulcan Iron Works
Westinghouse Electric & Mfg. Co.

Glassware, Chemical
Chemical Rubber Co.
Corning Glass Works

Graders, Gyratory & Vibrating
(See Screens, Inclined, Vibratory, Gyratory, etc.)

Graphite
Dixon Crucible Co.

Grates
Erie City Iron Works

Gratings & Ventilators, Area, Sidewalk, Floor, etc., Metallic
Hendrick Mfg. Co.
Irving Iron Works Co.

Grinding Mills & Pulverizers
(See Crushers, Grinding Mills and Pulverizers)

Hard Rubber Products
American Hard Rubber Co.
Goodrich Rubber Co., B. F.
U. S. Rubber Co.

Heaters, Feed Water
Erie City Iron Works
Worthington Pump & Mch. Co.

Heating Elements, Electrical
Driver-Harris Co.
Hoskins Mfg. Co.

Heating Systems & Accessories
American Blower Co.
Fulton Co.
Kemp Manufacturing Co.
Louisville Drying Machinery Co.
Mettler & Co., Lee B.
Parks-Cramer Co.
Surface Combustion Co.

Hoists
Chicago Pneumatic Tool Co.
Fairbanks-Morse & Co.
General Electric Co.
Sullivan Machinery Co.
Vulcan Iron Works
Wellman-Seaver-Morgan Co.

Hose
Chicago Pneumatic Tool Co.
Cincinnati Rubber Mfg. Co.
U. S. Rubber Co.

Hydro-Extractors
(See Centrifugals)

Industrial Heat, Gas
American Gas Ass'n
Mettler, Lee B.
U. G. I. Contracting Co.

Industrial Plant Sites
Atlanta, City of
Central of Georgia Railway

Instruments, Testing
Bausch & Lomb Optical Co.
Bristol Co., The
Brown Instrument Co.
La Motte Chemical Products Co.
Leeds & Northrup Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

Chemical Drying by the "HURRICANE" Method

The "HURRICANE" Cabinet Tray Dryer illustrated is a quick-acting machine for small quantities of Chemicals, Dyes, Food Products, etc. Continuous Machines and Tunnel Truck Types are built for larger capacities. A complete line of commercial drying equipment, backed by over a quarter of a century of experience.

State the nature of the product you desire to dry. We will supply detailed information regarding a Dryer of guaranteed capacity

THE PHILADELPHIA DRYING MACHINERY CO.

Stokley St. above Westmoreland, PHILADELPHIA, PA.

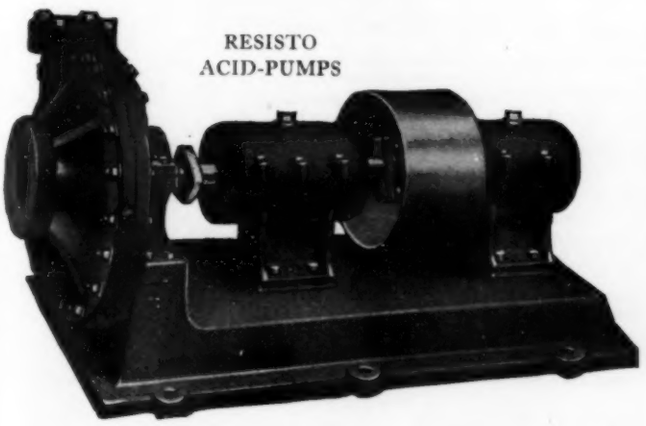
Canadian Agents:
Ross Whitehead & Company, Ltd.
Montreal

HURRICANE
Ideal Drying Every Day

New England Agency:
Hurricane Engineering Company
53 State St., Boston, Mass.

The "Proof" Mark Of Consistent Resistance

RESISTO



RESISTO
ACID-PUMPS

RESISTO PIPE & VALVE CO.
262 BRIDGE ST., E. CAMBRIDGE, MASS.
New York Office: 1133 Broadway
Phone: Watkins 6141

Guaranteed Results

Wherever lead contact is required!

Practically every industry has use for RESISTO Equipment in processes where acid resistance, durability and economy render it equal or superior to any other material procurable.

We recommend

RESISTO Acid Resisting Pipe Valves, Fittings, Pumps, Tanks, Etc.

All Lead or Lead Lined

We furnish and install complete plant equipment.

Protect your product by using Resisto Acid Resisting Material.

Write for Catalog

Insulating Material, Heat, Electric & Molded
Armstrong Cork & Insulation Co.
Bakelite Corp.
Celite Products Co.

Iron, Malleable

Jars or Storage Pots, Acid Proof
(See Chemical Stoneware, Acid Proof)

Jigs, Coal
Hardinge Co.

Kettles, Cast Iron
Bethlehem Fdy. & Machine Co.
Buffalo Fdy. & Vacuum Machy. Co.
Chemical & Vacuum Machinery Co.
Sperry & Co., D. R.

Kettles, Copper
Copper & Brass Research Assn.

Kettles, Enamelled
Glascote Co.

Kettles, Steam-Jacketed
Aluminum Co. of America
Bethlehem Fdy. & Machine Co.
Buffalo Fdy. & Machine Co.
Chemical & Vacuum Machy. Co.
Koven & Bro., L. O.
New York Engineering Co.
Pfaudler Co.
Sowers Mfg. Co.
Sperry & Co., D. R.

Kettles, Stoneware
Knight, Maurice A.
U. S. Stoneware Co.

Kettles, Varnish
Buffalo Fdy. & Machine Co.

Kilns, Rotary and Vertical
Bartlett & Snow Co., C. O.
Louisville Drying Machinery Co.
Manitowoc Engrg. Works
McGann Manufacturing Co.
New York Engineering Co.
Ruggles-Coles Eng. Co.
Vulcan Iron Works

Laboratory App. and Supplies
Alberene Stone Co.
Braun Corporation
Braun-Knecht-Heimann Co.
Buffalo Dental Mfg. Co.
Chemical Treatment Co.
Denver Fire Clay Co.
Heil, Henry, Chemical Co.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Palo Co.
Sargent, E. H., & Co.
Thermo Electric Instrument Co.
Tolhurst Machine Works
Trimount Rotary Power Co.

Laboratory Furniture
Chemical Rubber Co.
Kewaunee Mfg. Co.
Peterson & Co., Inc., Leonard

Lacing, Belt
(See Belt Lacing)

Lead Burning
Gross Lead Burning & Coating Co.

Lightning Rods, Chimney
Custodis Chimney Co., Alphons

Lime, Chemical and Hydrated
Hunkins-Willis Lime & Cement Co.
Louisville Cement Co.
Marblehead Lime Co.
New England Lime Co.

Loaders & Unloaders, Portable
Jeffrey Mfg. Co.

Locomotives, Industrial
Fate-Root-Heath Co.
General Electric Co.
Jeffrey Mfg. Co.
Vulcan Iron Works
Westinghouse Electric & Mfg. Co.

Machinery, Agitating
Day, J. H., Co.
Guild & Garrison, Inc.
Mixing Equipment Co.
New York Engineering Co.
Patterson Fdy. & Machine Co.
Sowers Mfg. Co.

Machinery, Cement Making
Gruendler Patent Crusher & Pulverizer Co.

Machinery, Coal Handling
Bartlett & Snow Co.
Jeffrey Mfg. Co.
Standard Conveyor Co.
Webster Mfg. Co.
Wellman-Seaver-Morgan Co.

Machinery, Conveying and Elevating
(See Conveying Machinery and Equipment)

Machinery, Crushing, Grinding & Pulverizing
Abbe, Paul O.
Abbe Engineering Co.
Allis-Chalmers Mfg. Co.
Bartlett & Snow Co.
Braun-Knecht-Heimann Co.
Combustion Engineering Corp'n
Day Co., J. H.
Erie City Iron Works
Gay Co., Rubert M.
Gruendler Patent Crusher & Pulverizer Co.
Hardinge Co.
International Combustion Engineering Corp'n
Jeffrey Mfg. Co.
Kent Mill Co.
Patterson Fdy. & Machine Co.
Raymond Bros. Impact Pulv. Co.
Robinson Mfg. Co.
Sturtevant Mill Co.
Swenson Evaporator Co.

Machinery, Drying
(See Drying Machinery)

Machinery, Material Handling
Wellman-Seaver-Morgan Co.

Machinery, Mixing and Kneading
Abbe, Paul O.
Abbe Engineering Co.
Baker, Perkins Co., Inc.
Day, J. H., Co.
Koven & Bro., L. O.
Mixing Equipment Co.
Robinson Mfg. Co.
Ruggles-Coles Eng. Co.
Sowers Mfg. Co.
Stokes Machine Co., F. J.

Machinery, Refrigerating
Worthington Pump & Mch. Corp.

Machinery, Screening
Hardinge Co.
Kent Mill Co.
New York Engineering Co.
Southwestern Engineering Corp.
Sturtevant Mill Co.
Webster Mfg. Co.

Machinery, Special
Guild & Garrison, Inc.
McGann Manufacturing Co.
Proctor & Schwartz, Inc.
Wellman-Seaver-Morgan Co.

Machinery, Thickening & Dewatering
American Tool & Mach. Co.
Dorr Co.
Filtration Engineers, Inc.
Hardinge Co.
Tolhurst Machine Works
United Filters Corp'n

Machinery, Transmission
Morse Chain Co.
Schaffer Poidometer Co.
U. S. Rubber Co.
Webster Mfg. Co.

Machinery, Weighing
American Machine & Foundry Co.
Merrick Scale Co.

Magnesium Metal
Dow Chemical Co.

Magnetic Separators
Ding's Magnetic Separator Co.

Manganese
Electro Metallurgical Sales Corp'n
Metal & Thermit Co.

Metal Coating and Plating
Chemical Treatment Co., Inc.
Metals Coating Co. of America.

Metallographic Equipment
Bausch & Lomb Optical Co.
Chemical Treatment Co.

Meters, Flow, Air, Gas Steam, Water, Coal
Bailey Meter Co.
Brown Instrument Co.
Connersville Blower Co.
General Electric Co.
Leeds & Northrup Co.
Roots Co., P. H. & F. M.
Westinghouse Electric & Mfg. Co.

Microscopes
Bausch & Lomb Optical Co.
Sargent, E. H., & Co.

Mills, Attrition, Ball, Pebble and Tube
Abbe, Paul O.
Abbe Engineering Co.
Day, J. H., Co.
Hardinge Co.
Patterson Fdy. & Mach. Co.
Robinson Mfg. Co.
Southwestern Engineering Corp.

Mixers
Abbe, Paul O.
Abbe Engineering Co.
Baker-Perkins Co., Inc.
Bartlett & Snow Co.
Mixing Equipment Co.
Patterson Fdy. & Mach. Co.
Sowers Mfg. Co.

Monel Metal, Sheet, Rod, Wire & Castings
Alloy Metal Wire Co.
Driver-Harris Co.
Electrical Alloy Co.
International Nickel Co.
Pacific Foundry Co.

Motors, Electric
Fairbanks, Morse & Co.
General Electric Co.
Lincoln Electric Co.
Westinghouse Electric & Mfg. Co.

Muffles
Carborundum Co.
Denver Fire Clay Co.
Norton Co.

Nickel, Sheet, Rod, Wire, Strip, Castings, etc.
American Nickel Corp.
Driver-Harris Co.
International Nickel Co.

Nitrators
Bethlehem Fdy. & Mach. Co.
Buffalo Fdy. & Machine Co.
Chemical & Vacuum Machinery Co.
Tolhurst Machine Works

Nitrogen
International Oxygen Co.
Linde Air Products Co.

Nozzles, Spray
Buffalo Forge Co.
Chicago Pneumatic Tool Co.
Hardinge Co.
Monarch Mfg. Works
Spray Eng. Co.

Oil Burning Systems
Chicago Pneumatic Tool Co.
Todd Dry Dock, Engineering & Repair Corp'n

Oil Circulating Systems, Industrial Heating
Parks-Cramer Co.

Oil Engines, Diesel
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Todd Dry Dock, Engineering & Repair Corp'n

Ovens, Electric, Laboratory
Thermo Electric Instrument Co.

Ovens, Industrial
General Electric Co.
Koppers Co.
Thermo Electric Instrument Co.

Oxy-Acetylene Apparatus

Welding & Cutting
International Oxygen Co.

Oxygen Gas
International Oxygen Co.
Linde Air Products Co.

Packing, Asbestos, Flax, Rubber, Metallic
Garlock Packing Co.
Johns-Manville, Inc.

Packing, Metal
Garlock Packing Co.

Paint & Varnish
Dixon Crucible Co.

Paint, Varnish and Lacquer Machinery
Abbe, Paul O.
Abbe Engineering Co.
Patterson Fdy. & Machine Co.

Pans, Vacuum
(See Crystallizing Equipment)

Perforated Metals
Hendricks Mfg. Co.

Pipe & Fittings, Brass
Cleveland Brass Mfg. Co.
Copper & Brass Research Ass'n

Pipe and Fittings, Cast Iron
Albright Son & Co.
Gross Lead Burning & Coating Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe & Fittings, Lined with Lead, Tin, Brass, Etc.
Metals Coating Co. of Amer.
Lead-Lined Iron Pipe Co.
Resisto Pipe & Valve Co.
United Lead Co.

Pipe & Fittings, Metal, Acid Proof
Aluminum Co. of America
Duriron Co., The
International Nickel Co.
Merco Nordstrom Valve Co.
Whitehead Metal Products Co.

Pipe & Fittings, Rubber Lined
American Hard Rubber Co.
Goodrich Rubber Co., B. F

Pipe & Fittings, Stoneware, Acid Proof
(See Chemical Stoneware, Acid Proof)

Pipe Covering, Fittings, etc.,
Armstrong Cork & Insulation Co.
Johns-Manville, Inc.

Piping Jacketed
Parks-Cramer Co.

Pipe, Silica Ware
Thermal Syndicate, Ltd.

Plates, Porous
Norton Co.

Platinum Wire, Sheet, Foil Crucibles, Lab. Ware, all kinds
American Platinum Works
Baker & Co., Inc.

Porcelain Grinding Balls
McDanel Refractory Porcelain Co.

Porcelain Linings
McDanel Refractory Porcelain Co.

Porcelain Ware
Chemical Rubber Co.
Engelhard, Charles, Inc.

Pottery, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Pottery and Clay Machinery
Patterson Fdy. & Machine Co.

Powdered Coal Equipment
Hardinge Co.

Power Plant Equipment
Bristol Company, The
Chicago Pneumatic Tool Co.
General Electric Co.
Jeffrey Mfg. Co.
Leeds & Northrup Co.
Todd Dry Dock Engineering & Repair Corp'n
Webster Mfg. Co.
Westinghouse Electric & Mfg. Co.

Power Transmission Equipment
Erie City Iron Works
Westinghouse Electric & Mfg. Co.

Precipitation, Electrical
Western Precipitation Co.

Presses, Continuous
California Press Mfg. Co.

Presses, Hydraulic
California Press Mfg. Co.
French Oil Mill Machy. Co.
Hydraulic Press Mfg. Co.
Perrin & Co., Wm. H.
Southwork Fdry. & Mach. Co.
Watson-Stillman Co.
Wellman-Seaver-Morgan Co.

Producer Gas Machines
Morgan Construction Co.
Smith Gas Engrg. Co.
U. G. I. Contracting Co.
Wellman-Seaver-Morgan Co.

Protection Coatings, High Temperature
Metals Coating Co. of Amer

Pulleys, Magnetic
Ding's Magnetic Separator Co.

Pulverized Coal Equipment
Abbe, Paul O.
Abbe Engineering Co.
Combustion Engineering Corp'n
Erie City Iron Works
Hardinge Co.
International Combustion Engineering Corp'n
Kent Mill Co.
Raymond Bros. Impact P. Co.
Swenson Evaporator Co.

Pulverizers, Ore
(See Machinery, Crushing, Grinding and Pulverizing)

Pumps, Acid Proof
American Machine & Foundry Co.
American Well Works
Beach-Russ Co.
Buffalo Forge Co.
Economy Pumping Machinery Co.
Goulds Pumps, Inc.
Oliver Continuous Filter Co.
Resisto Pipe & Valve Co.
Roots Co., P. H. & F. M.
Taber Pump Co.
United Lead Co.

Pumps, Air Lift
(See Air Lifts)

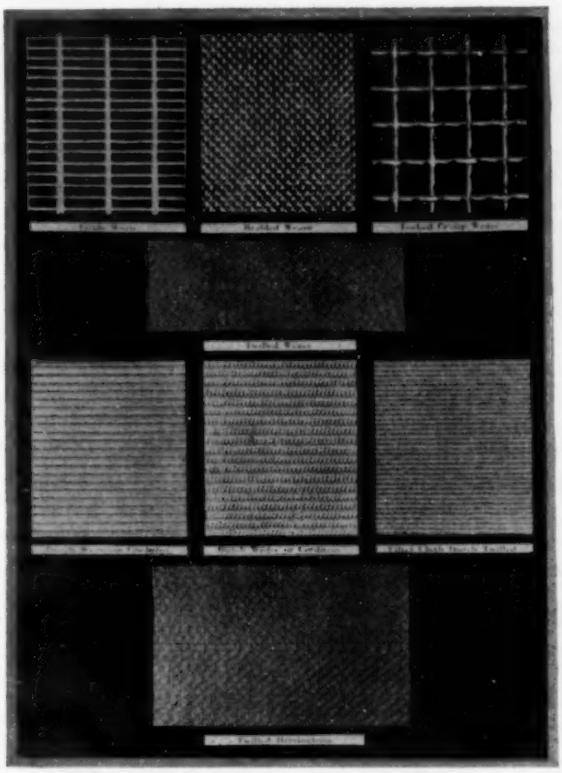
TYPOGRAPHICAL ERROR

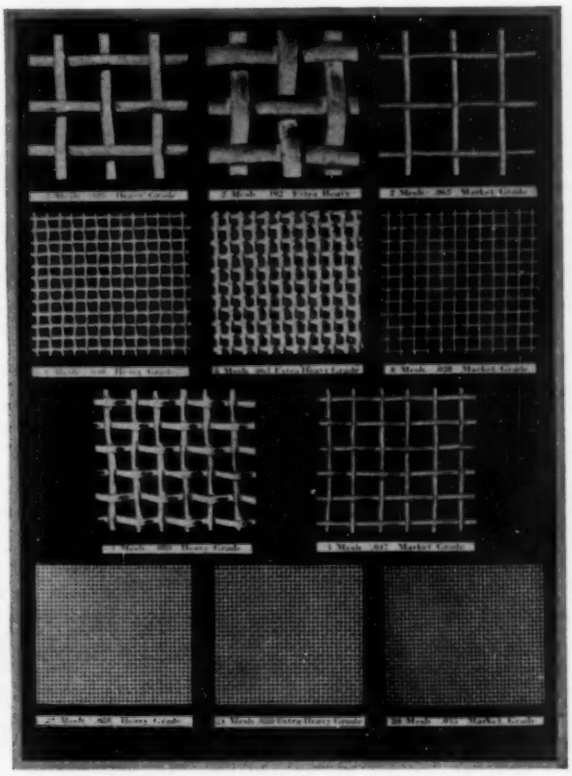
In the CHEMICAL CONSTRUCTION Co. advertisement of April issue, page 33.

$1+2SO_4$ should read H_2SO_4

All PROCESS PLANTS

HAVE USES FOR JELLIFF WIRE PRODUCTS





Wire Cloth and China Clay

As a "filler," China Clay has many uses throughout the Process Industries, and in this capacity it must be reduced to various sized particles. Screening is one of the most important processes in the preparation of this product.

Manufacturers of China Clay, like the producers of all raw and finished products of the Process Industries requiring the use of wire cloth, screens or baskets in their production find in our stocks a selection of standard weaves so liberal that every commercial need can be supplied.

There is a Jelliff Wire Cloth that most economically fits your needs. Let our engineers who have had a wealth of experience in the Process Industries advise you as to the Jelliff Wire Cloth Product that best meets your needs.

THE C. O. JELLIFF MFG. CORP.

SOUTHPORT, CONN.

Representatives:

Central Steel & Wire Co., 4545 South West Blvd., Chicago, Illinois.
Central Steel & Wire Co., Bellevue and Warren St., Detroit, Michigan.
H. F. Chase, 350 Madison Avenue, New York City, N. Y.
Equitable Equipment Co., 520 Toulouse Street, New Orleans, Louisiana.
Steele-Sayward, 79 Milk Street, Boston, Massachusetts.
B. M. Pilhashy, 532 Merchants Exchange Bldg., San Francisco, Calif.
H. F. Wageman, 21 Ayres Street, Binghamton, N. Y.

JELLIFF Wire Cloth

is produced in a wide variety of standard weaves to meet every commercial need. It can be supplied as filter cloths, screening cloths, baskets and other mechanical shapes and is available in any of the following metals:

Steel	Bronze
Monel	Phosphor Bronze
Copper	Brass

and in any of precious metals on order.

Pumps, Centrifugal
American Well Works
Buffalo Forge Co.
De Laval Steam Turbine Co.
Duriron Co.
Economy Pumping Machinery Co.
Fairbanks, Morse & Co.
Goulds Pumps, Inc.
Krogh Pump & Machinery Co.
Taber Pump Co.
Wilfley & Sons, A. R.

Pumps, Hydraulic
French Oil Mill Machy. Co.

Pumps, Power
Fairbanks, Morse & Co.

Pumps, Rotary
American Machine & Foundry Co.
Beach-Russ Co.
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Roots Co.
Taber Pump Co.
Trimont Rotary Power Co.
Wilfley & Sons, A. R.

Pumps, Sand
Fairbanks, Morse & Co.
Krogh Pump & Machy. Co.
Wilfley & Sons, A. R.

Pumps, Steam
Buffalo Forge Co.
De Laval Steam Turbine Co.
Fairbanks, Morse & Co.
Guild & Garrison, Inc.
Watson-Stillman Co.

Pumps, Vacuum
American Machine & Foundry Co.
Beach-Russ Co.
Buffalo Fdry. & Mch. Co.
Chemical & Vacuum Machinery Co.
Chicago Pneumatic Tool Co.
Connersville Blower Co.
Devine Co., J. P.
Guild & Garrison, Inc.
The Norwalk Co.
Oliver Continuous Filter Co.
Roots Co.
Sullivan Machinery Co.
Trimont Rotary Power Co.

Pyrometer Protection Tubes
Bristol Company, The
Brown Instrument Co.
Carborundum Co.
Engelhard, Charles, Inc.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Thermal Syndicate, Ltd.

Pyrometers
Bristol Co., The Inc.
Brown Instrument Co.
Engelhard, Charles, Inc.
Hoskins Mfg. Co.
Leeds & Northrup Co.

Recorders, CO_2
Brown Instrument Co.

Recorders, Specific Gravity
Bailey Meter Co.

Recording Instruments
Amer. Schaeffer & Budenberg Corp.
Bailey Meter Co.
Bristol Co., The
Brown Instrument Co.
Engelhard, Charles, Inc.
La Motte Chemical Products Co.
Leeds & Northrup Co.
Moto-Meter Co

Reels, Sifting
Day Co., J. H.
Robinson Mfg. Co.

Refractometers
Bausch & Lomb Optical Co.

Refractories
Bartley Crucible Co.
Carborundum Co.
General Refractories Co.
Johns-Manville, Inc.
McDanel Refractory Porcelain Co.
Norton Co.

Refractory Brick Work
Chemical Appliances, Inc.
Custodis Chimney Co.

Regulators, Pressure and Temperature
American Schaeffer & Budenberg Corp.
Bristol Company, The
Brown Instrument Co.
Engelhard, Charles, Inc.
Fulton Co.
General Electric Co.
Mason Regulator Co.
Moto-Meter Co.
Powers Regulator Co.

Repairing Blow Hole, Castings, Machinery Tools
Metals Coating Co. of Amer.

Resistance Material, Electric
Driver-Harris Co.

Rhodium
Baker Platinum Works

Roofing, Siding, Sheets & Shingles, Plain & Corrugated
Aluminum Co. of America
Copper & Brass Research Assn.
Johns-Manville, Inc.
New Jersey Zinc Co.
Robertson Co., H. H.

Rust-Proofing
Metals Coating Co. of Amer.
Parker Rust-Proofing Co.
Udylite Process Co.

Saccharimeters
Bausch & Lomb Optical Co.

Sacks
Chase Bag Co.

Salt
International Salt Co.
Pennsylvania Salt Mfg. Co.

Scales
Fairbanks, Morse & Co.
Merrick Scale Co.

Screens, Inclined, Vibrating, Gyratory, etc.
Bartlett & Snow Co.
Day Co., J. H.
Gay Co., Rubert M.
Kent Mfg. Co.
Robinson Mfg. Co.
Simpson Co., The Orville
Southwestern Engineering Corp.
Sturtevant Mill Co.

Screens, Wire, Brass, Copper and Steel
Buffalo Wire Wks.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
Hendricks Mfg. Co.
Jelliff Mfg. Corp'n, C. O.
Ludlow-Saylor Wire Co.
Multi-Metal Co.
Newark Wire Cloth Co.
Wickwire-Spencer Steel Corpn.

Second-Hand Equipment
(Searchlight Section)
Consolidated Products Co.
Heineken, W. P. & Co.
Kehoe, Robt. P.
Lawlor, Edward W.
F. J. Lewis Mfg. Co.
Lungwitz, Emil E.
Machinery & Equipment Co.
Miller, I.
Monsanto Chemical Wks.
Nashville Industrial Corp'n
Norris, E. E.
Stein-Brill Corp.
United Utilities, Inc.
Wilson-Hock Co.

Separators, Air, Gas
Gay Co., Rubert M.
Hardinge Co.
Kent Mill Co.
Raymond Bros. Impact Pulverizer Co.
Sturtevant Mill Co.

Separators, Centrifugal
American Tool & Machine Co.
Fletcher Works
Gay Co., Rubert M.
Tolhurst Machine Works

Separators, Inclined Vibratory, etc.
(See Screens, Inclined, Vibratory, Gyratory, etc.)

Sheet Metal Work
Koven & Bro., L. O.

Sheets, Rubber Lined
Goodrich Rubber Co., B. F.

Sieves, Laboratory
Buffalo Wire Wks.
Chicago Perforating Co.
Jelliff Mfg. Corp'n
Ludlow-Taylor Wire Co.
Multi-Metal Co.
Newark Wire Cloth Co.
Wickwire-Spencer Steel Corp.

Sifters, Gyratory, Vibrating, etc.
(See Screens, Inclined, Vibratory, Gyratory, etc.)

Silica, Powdered
American Tripoli Co.

Silicate of Soda
Diamond Alkali Co.

Sinks, Laboratory, Acid Proof
Alberene Stone Co.
Knight, Maurice A.

Skylights
Robertson Co., H. H.

Solvents
Commercial Solvents Corp.

Solvent Recovery Equipment
American Solvent Recovery Corp.
Barnebey-Cheney Eng. Co.
Buffalo Foundry & Machine Co.
Chemical & Vacuum Machinery Co.
New York Engineering Co.
Scott & Co., Ernest
Spadone Machine Co.

Solvents, Inflammable and Non-Inflammable
Carbide & Carbon Chemical Corp.
Commercial Solvents Corp'n
Dow Chemical Co.
U. S. Industrial Chem. Co.

Spectrometers
Palo Co.

Speed Reducers
Cleveland Worm & Gear Co.
Philadelphia Gear Works

Spray Drying Systems
Spray Dryer Process Corp.

Spray Nozzles
(See Nozzles, Spray)

Spray Systems
Hardinge Co.
Spray Engr'g Co.

Stacks and Standpipes
Erie City Iron Works

Stair Steps, Safety
Carborundum Co.
Hendrick Mfg. Co.
Irving Iron Works Co.

Steel Bars, Billetts, Plates & Shapes, Cold Rolled & Strip
Central Steel Co.
Ludlum Steel Co.
Ryerson & Son, Jos. T.

Steel, High Speed
Central Steel Co.
Ludlum Steel Co.

Steel Plate Products
Erie City Iron Works
Pittsburgh-Des Moines Steel Co.

Steel Structural
Ryerson & Son, Jos. T.

Steam Traps
Johns-Manville, Inc.

Stills, Plugs
Merco Nordstrom Valve Co.

Stills, Water
Barnstead Still & Sterilizer Co.
Precision Scientific Co.
Stokes Machine Co., F. J.

Stokers
Babcock & Wilcox Co.
Combustion Engineering Corp'n
International Combustion Engineering Corp'n
Westinghouse Electric & Mfg. Co.

Stoneware, Acid Proof
(See Chemical Stoneware, Acid Proof)

Strainers
Mason Regulator Co.

Structural Steel Work
Erie City Iron Works

Sulphonators
Bethlehem Fdy. & Machine Co.
Buffalo Foundry & Machine Co.
Chemical & Vacuum Machinery Co.

Sulphur
Texas Gulf Sulphur Co.

Sulphur Dioxide, Anhydrous
King Chemical Co.

Superheaters
Babcock & Wilcox Co.

Switches & Switchboards
General Electric Co.
Westinghouse Electric & Mfg. Co.

Syphons, Acid
Monarch Mfg. Wks.

Tachometers
American Schaeffer & Budenberg Corp'n
Bristol Company, The
Brown Instrument Co.

Tanks, Copper
Copper & Brass Research Assn.

Tanks, Enameled
Glascote Co.
Pfaudler Co.
Vitreous Enameling Co.

Tanks, Iron and Steel
Erie City Iron Works
General Tank Corpn.
Koven & Bro., L. O.
Manitowoc Engrg. Works
McGann Manufacturing Co.
New York Engineering Co.
Pressed Steel Tank Co.

Tanks, Lead Lined
General Tank Corp'n
Gross Lead Burning & Coating Co.
Hauser-Stander Tank Co.
Koven & Bro., L. O.
Lead-Lined Iron Pipe Co.
Resisto Pipe & Valve Co.
United Lead Co.

Tanks, Rubber-Lined
American Hard Rubber Co.
General Tank Corp'n
Goodrich Rubber Co., B. F.
Hauser-Stander Tank Co.

Tanks and Vats, Wood
Atlantic Tank & Barrel Corp'n
Hauser-Stander Tank Co.
Woolford Wood Tank Co.

Tanks & Vats, Stoneware, Acid Proof
(See Chemical Stoneware, Acid Proof)

Tanks and Vats, Wood,
General Tank Corp'n
Hauser-Stauder Tank Co.

Tanning Extracts
Industrial Chemical Co.

Testing Laboratories
(See Professional Directory)

Thermometers
Amer. Schaeffer & Budenberg Corpn.
Bailey Meter Co.
Bristol Company, The
Brown Instrument Co.
Engelhard, Charles, Inc.
La Motte Chemical Products Co.
Leeds & Northrup Co.
Moto-Meter Co.

Thickeners
(See Machinery, Thickening and Dewatering)

Tile or Blocks, Acid Proof
Knight, Maurice A.
U. S. Stoneware Co.

Tower Packing or Filling
Bregeat Corp'n of America
Chemical Appliances, Inc.
Chemical Construction Co.
General Ceramics Co.
Knight, Maurice A.
U. S. Stoneware Co.

Towers & Accessories, Acid Proof Stoneware
(See Chemical Stoneware, Acid Proof)

Transformers
Allis-Chalmers Mfg. Co.
American Transformer Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

Transmission Equipment
Cincinnati Rubber Mfg. Co.
Goodrich Rubber Co., B. F.
Morse Chain Co.

Traps, Air, Steam, Return, and Non-Return, etc.
Johns-Manville, Inc.

Trays, Evaporating & Drying
Buffalo Fdy. & Machine Co.
Thermal Syndicate, Ltd.

Treads, Safety, Stair & Ladder
Hendrick Mfg. Co.
Irving Iron Works Co.

Tripoli
Amer. Tripoli Co.

Tubes, Silica
Thermal Syndicate

Turbines, Steam
De Laval Steam Turbine Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

Valves & Accessories, Hi-Pressure
Hydraulic Press Mfg. Co.
Merco Nordstrom Valve Co.
Southwark Fdry. & Mach. Co.
Steel Improvement & Forge Co.
Watson-Stillman Co.

Valves & Cocks, Stoneware Acid Proof
(See Stoneware, Chemical, etc.)

Valve Discs
Garlock Packing Co.

Valves and Fittings, Brass
Cleveland Brass Mfg. Co.
Merco Nordstrom Valve Co

Valves and Fittings, Metal Acid Proof
American Manganese Bronze Co.
Duriron Co.
Jenkins Bros.
Merco Nordstrum Valve Co.

Valves & Fittings, Lead-Lined
Lead-Lined Iron Pipe Co.
Resisto Pipe & Valve Co.
United Lead Co.

Valves, balanced, float, Reducing, etc.
Mason Regulator Co.

Valves, Pump, Rubber
Garlock Packing Co.
Johns-Manville, Inc.

Valves, Special
American Manganese Bronze Co.
Fulton Co.
Garlock Packing Co.
Jenkins Bros.
Merco Nordstrum Valve Co.
Monarch Mfg. Works
Moto-Meter Co.
Powers Regulator Co.

Ventilating Apparatus
American Blower Co.
Buffalo Forge Co.
Dust Recovering & Conveying Co.
General Electric Co.
Holly Pneumatic System, Inc.
Jeffrey Mfg. Co.
Robertson Co., H. H.

Vibrating Screens
Bartlett & Snow Co.
Kent Mill Co.
Simpson Co., The Orville

Waterproofing Compounds
Asphalt Products Co.
Celite Products Co.
Johns-Manville, Inc.

Welding Apparatus
Elkon Works, Inc.

Well Drilling Equipment
American Well Works

Welding, Gas.
Prest-O-Lite Co.

Wire Cloth
Baker Platinum Works
Buffalo Wire Wks.
Chicago Perforating Co.
Cleveland Wire Cloth & Mfg. Co.
Jelliff Mfg. Corp'n, C. O.
Ludlow-Saylor Wire Co.
Multi-Metal Co.
Newark Wire Cloth Co.
New Jersey Wire Cloth Co.
Wickwire-Spencer Steel Corp'n

Wire, Heat & Acid Resisting
Driver-Harris Co.
General Electric Co.
Hybinette, Victor

Zinc, Sheets and Coils
New Jersey Zinc Co.

HOLLY

AUTOMATIC DUST COLLECTING SYSTEMS

HOLLY DUST COLLECTING AND RECLAIMING SYSTEMS cover all phases of the highly specialized problems involved in the elimination of industrial dusts and fumes. Available with Holly equipment are years of unusually extensive experience in the solution of dust problems in industry, both here and abroad.

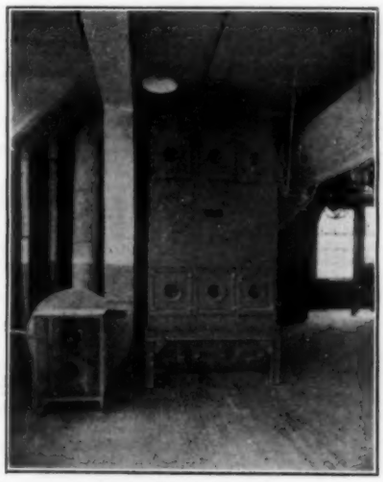
End the Hazards—Damages—Wastes and Expenses Caused by Dust!

Your process dusts may be poisonous or injurious to personnel. They may cause unpleasant or hazardous working conditions, and lead to high labor turnover, inefficiency and accidents. They may damage raw and intermediate materials and finished products, or cause excessive wear and operating costs on much of your equipment. Often a process dust has a surprisingly high recovery value, unsuspected until recovery has been tried. Of course, if your process dust is combustible, it is also inevitably a potential explosive.

Let us show you how and where the proper Holly Dust Collecting System will pay for itself in your plant—no matter what the volume of dust involved may be.

Ask for a copy of our new catalog—now on the press.

5-compartment
Holly Automatic Cloth Suction Filter
R. B. Davis Co., Hoboken, N. J.



3-compartment
Holly Automatic Cloth Suction Filter
R. B. Davis Co., Hoboken, N. J.

Holly Automatic Cloth Suction Filters in a Chemical Plant

The R. B. Davis Co., Hoboken, N. J., manufacturers of baking powder, have been using Holly installations for seven years. These installations recover about 500 lbs. of valuable material per day.

HOLLY PNEUMATIC SYSTEMS, INC., 96 E. 45th ST., NEW YORK CITY

ALPHABETICAL INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Chemical and Metallurgical Engineering* assumes no responsibility for errors or omissions

	Page
Abbe, Paul O	144
Abbe Engineering Co	143
Abernathy & Co., John F	160
Alberene Stone Co	170
Albright Son & Co	116
Alcumite Corp'n	40
Allegheny Steel Co	91
Allis-Chalmers Mfg. Co	126
Aluminum Company of America	193
American Blower Co	139
American Gas Ass'n	32
American Hard Rubber Co	116
American Machine & Fdry. Co	12
American Nickel Corp'n	82 and 83
American Platinum Works	171
American Schaeffer & Budenberg Corp	98
American Solvent Recovery Corp	80
American Tool & Machine Co	140
American Transformer Co	159
American Tripoli Co	80
American Well Works	133
Angel & Co., H. Reeve	148
Armstrong Cork & Insulation Co	161
Arnold Hoffman & Co	72
Atlanta, City of	181
Atlantic Tank & Barrel Corp'n	158
Babcock & Wilcox Co	108
Badger & Sons Co., E. B	100
Bailey Meter Co	99
Bakelite Corp	50
Baker & Co., Inc., Platinum Wks	169
Baker-Perkins Co., Inc	145
Barnstead Still & Sterilizer Co	67
Bartlett & Snow Co., C. O	121
Bartley Crucible Co., Jonathan	53 and 111
Bausch & Lomb Optical Co	170
Beach-Russ Co	143
Best Corporation, W. N	106
Bethlehem Fdry. & Machine Co	122
Braun Corporation	176
Braun-Knecht-Heimann Co	176
Bregeat Corp'n	160
Bristol Co., The	Back Cover
Brown Instrument Co	113
Buffalo Dental Mfg. Co	112
Buffalo Forge Co	132
Buffalo Fdry. & Machine Co	60
Buffalo Steam Pump Co	132
Buffalo Wire Wks	152
California Press Mfg. Co	148
Carbide & Carbon Chemicals Corp'n	71
Carborundum Co	107
Carrier Air Conditioning Co	132
Celite Products Co	33
Central of Georgia Railway	180
Central Steel Co	84
Chase Bag Co	156
Chemical Appliances, Inc	23
Chemical Catalog Co	65
Chemical Const. Co	21
Chemical Rubber Co	165
Chemical Treatment Co	86
Chemical & Vacuum Machinery Coc., In	51
Chicago Perforating Co	152
Chicago Pneumatic Tool Co	114
Chromium Products Corp'n	93
Cleveland Brass Mfg. Co	114
Cleveland Wire Cloth & Mfg. Co	155
Cleveland Worm & Gear Co	131
Combustion Engineering Corp'n	13 and 25
Commercial Solvents Corp'n	74
Connersville Blower Co., The	135
Copper & Brass Research Ass'n	88
Corning Glass Works	176
Custodis Chimney Co., Alphons	160
Darco Sales Corp'n	76
Day Co., J. H	146
De Laval Steam Turbine Co	136
Denver Fire Clay Co	164
Devine Co., J. P	16 ard 17
Diamond Alkali Co	78
Ding's Magnetic Separator Co	30
Dixon Crucible Co	80 and 110
Dorr Co	9
Dow Chemical Co., The	79
Driver-Harris Co	85
Duriron Co., Inc., The	41
Dust Recovering & Conveying Co	37
Economy Pumping Machinery Co	190
Electro Metallurgical Sales Corp'n	6
Elkon Works, Inc	191
Englehard, Charles, Inc	112
Erie City Iron Works	97
Fairbanks, Morse & Co	44 and 45
Fansteel Products Co	87
Fate-Root-Heath Co	128
Filtration Engineers, Inc	148
Fletcher Works, Inc	69
French Oil Mill Machinery Co., The	138
Fulton Co	175
Garlock Packing Co	96
Gay Co., Robert M	140
General Ceramics Co	119
General Chemical Co	73
General Electric Co	28, 29, 104 and 105
General Tank Corp., The	156
General Refractories Co	118
Glascote Co., The	158
Goodrich Co., B. F	31
Goulds Pumps, Inc	61
Gross Lead Burning & Coating Co	158
Gruendler Patent Crusher & Pulverizer Co	146
Guild & Garrison, Inc	132
Hardinge Co	42 and 43
Hauser-Stander Tank Co	189
Heil Chemical Co., Henry	166
Hendrick Mfg. Co	98
Hevi-Duty Electric Co	110
Holly Pneumatic Systems, Inc	199
Hoskins Manufacturing Co	22, 23 and 24
Hunkins-Willis Lime & Cement Co	74
Hybinette, Victor	89
Hydraulic Press Mfg. Co	138
Industrial Chemical Co	72
International Combustion Engineering Co	13 and 25
International Nickel Co	10 and 11
International Oxygen Co	130
International Salt Co	72
Irving Iron Works Co	102
Jeffrey Mfg. Co	124
Jelliff Mfg. Corp., C. O	197
Jenkins Bros	100
Johns-Manville, H. W., Inc	34
Kemp Manufacturing Co	106
Kent Mill Co	142
Kewaunee Mfg. Co	168
Kiefer Machine Co., Karl	150
King Chemical Co	76
Knight, Maurice A	Inside Back Cover
Koppers Co., The	66
Koven & Bro., L. O	174
Krogh Pump & Machy. Co	136
La Motte Chemical Products Co	168
Lead-Lined Iron Pipe Co	177
Leeds & Northrup Co	68
Lincoln Electric Co	48 and 49
Linde Air Products Co	5
Liquid Carbonic Co	78
Ludlow Saylor Wire Co	35 and 36
Louisville Cement Co	18
Louisville Drying Machy. Co	120
Ludlum Steel Co	90
McDanel Refractory Porcelain Co	118
McGann Manufacturing Co	120
McGraw-Hill Book Co	19 and 90 and 156
McGraw-Hill Publishing Co	46 and 47
Manitowoc Engrg. Co	120
Marblehead Lime Co	75
Mason Regulator Co	96
Merck & Co	166
Merco Nordstrom Valve Co	39
Merrick Scale Mfg. Co	128
Metal & Thermit Corp'n	90
Metals Coating Co. of America	92
Mettler Co., Lee B	108
Miner Laboratories	78
Mixing Equipment Co	150
Monarch Mfg. Wks	118
Morgan Construction Co	108
Morse Chain Co	164
Motor Meter Co	94
Multi-Metal Co	153
New England Lime Co	77
New Jersey Zinc Co	55
New York Engineering Co	122
Newark Wire Cloth Co	155
Norton Co	117
Norwalk Co., The	173
Oliver Continuous Filter Co	147
Orville Simpson Co., The	8
Pacific Foundry Co	92
Palo Co	176
Parker Rust Proof Co	92
Parks-Cramer Co	115
Patterson Fdy. & Machine Co	150
Pennsylvania Salt Mfg. Co	76
Perrin & Co., Wm. R	154
Peterson & Co., Inc., Leonard	168
Pfaudler Co	27
Philadelphia Drying Mach. Co	195
Philadelphia Gear Works	62
Pittsburgh-Des Moines Steel Co	158
Positions Vacant and Wanted	184 and 185
Powers Regulator Co	190
Precision Scientific Co	167
Pressed Steel Tank Co	157
Prest-O-Lite Co., Inc	4
Proctor & Schwartz, Inc	154
Professional Directory	178 and 179
Quigley Furnace Specialties Co., Inc	109
Raymond Bros. Impact Pulv. Co	14-15
Research Corpn	162
Resisto Pipe & Valve Co	195
Robertson Co., H. H	59
Robinson Mfg. Co	154
Rockwell Co., W. S	112
Roots Co., P. H. & F. M	190
Ruths Accumulator Co., Inc	101
Sargent & Co., E. H	166
Schaffer Poidometer Co	130
Scott & Co., Ernest	57
Searchlight Section	180-188
Sheet Steel Trade Extension Comm	63
Shriver & Co., T	149
Simpson Co., The Orville	8
Smith Gas Engrg. Co	110
Southwark Fdy. & Mch. Co	140
Southwestern Engineering Corp'n	102
Sowers Mfg. Co	128
Sperry & Co., D. R	141
Spray Eng. Co	122
Stacey Bros. Gas Construction Co	152
Standard Conveyor Co	172
Stokes Machine Co., F. J	142
Sturtevant Mill Co	125
Sullivan Mach. Co	137
Surface Combustion Co	52
Swenson Evaporator Co	64
Taber Pump Co	134
Texas Gulf Sulphur Co	79
Thermal Syndicate, Ltd	54
Thermo Electric Instrument Co	123
Timken Roller Bearing Co.,	Inside Front Cover
Todd Dry Dock & Engrg & Repair Co	163
Tolhurst Machine Works	7
Trimount Rotary Power Co	134
Udylite Process Co	88
U. G. I. Contracting Co., The	38
United Filters Corp	151
United Lead Co	20
U. S. Cast Iron Pipe & Fdy. Co	116
U. S. Industrial Chemical Co,	81
U. S. Rubber Co	95
U. S. Stoneware Co	103
Vulcan Iron Works	58
Watson-Stillman Co	144
Webster Mfg. Co	127
Wellman-Seaver-Morgan Co	56
Western Precipitation Co	160
Westinghouse Electric & Mfg. Co	128
Weston Electrical Instrument Co	136
Wickwire Spencer Steel Co	129
Worthington Pump Mch. Co	134
Zaremba Co	132

INDEX TO SEARCHLIGHT SECTION

Consolidated Products Co	185	Machinery & Equipment Co., Inc	184	Stein-Brill Corp'n	184
Heineken, W. P. & Co	184	Metallurgical & Chemical Corp'n	183	Technical Service Co	183
Kehoe, Robert P	183	Miller, I	183	United Utilities Inc	183
Lawlor, Edw. E	186	Monsanto Chemical Works	184	Verona Chem. Co	185
Lewis Mfg. Co., F. J	184	Nashville Industrial Corp'n	187	Wilson-Hock Co	186
Lungwitz, Emil E	183	Norris, E. E	183, 184 and 186		

Figure 202
Acid Proof Straightside Jar

Figure 320
Acid Proof Filtering Funnel

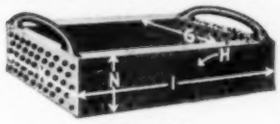


Figure 306
Acid Proof Dipping Tank

Figure 310
Acid Proof Mariotte or Closed Jar

Figure 265
Acid Proof Wire Roll

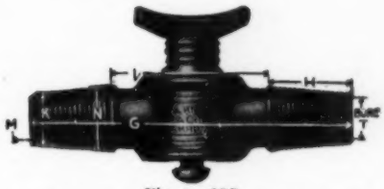


Figure 295
Acid Proof Threaded Straightway Cock

Our Guaranty Eliminates Your Buying Risk

You take no risk when you buy KNIGHT-WARE. Every piece is GUARANTEED acid-proof throughout its entire body, free from defects and satisfactory in EVERY respect.

We make every description of apparatus and equipment in Chemical Stoneware and are able to supply your needs regardless of how large or small they may be.

It will pay to communicate with us if you need Acid and Chemical Plant equipment complete or in part in Chemicalware, Acid Proof Jars, Tanks, Kettles, Filters, Faucets, Valves or Cocks, Sinks, Pipe and Fittings, Funnels, Pitchers, Buckets, Jugs, Dipping Tanks and Baskets, Acid Proof Brick and Cement, etc.

Let us help you with your problems.

Send for our illustrated and descriptive catalog

Figure 327
Acid Proof Bucket

MAURICE A. KNIGHT, AKRON, OHIO

GUARANTEED SATISFACTORY

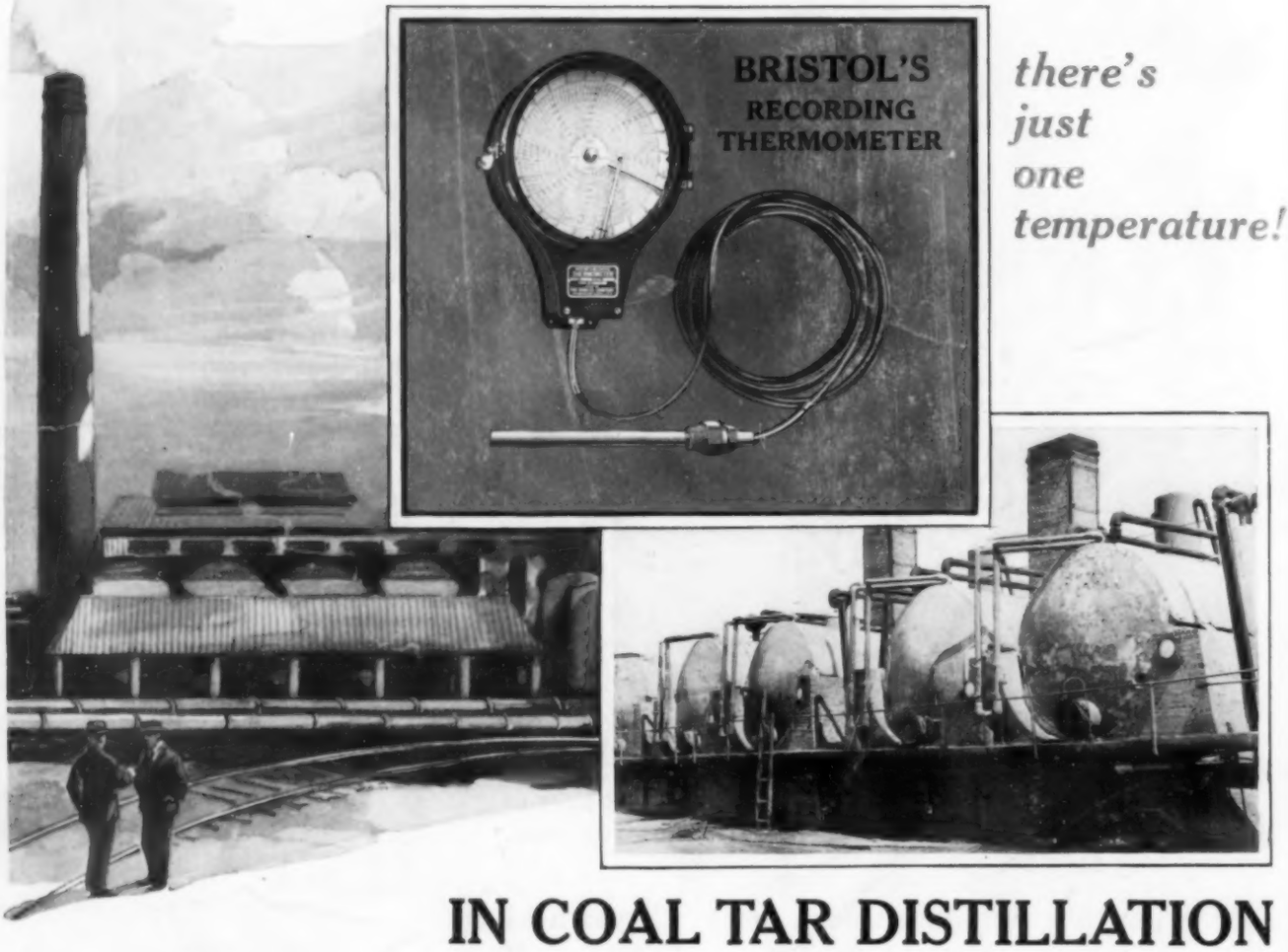
KNIGHT-WARE

ACID-PROOF CHEMICAL STONEWARE

"IT IS THE BODY ITSELF"

MAURICE A. KNIGHT AKRON, OHIO, U.S.A. CHEMICAL STONEWARE

For Such or Such a "Cut"



there's just one temperature!

IN COAL TAR DISTILLATION

The temperature at which vapor comes off the coal tar, in a fire-heated still, and goes into dephlegmator and cooling coils, actually determines the particular constituent that comes off at that distillation.

Such and such a cut at 100° . . . 140° . . . 180° . . ., for so many heating hours, determines whether the product shall be benzol, carbolic oil, creosote, anthracene, etc.

Temperature similarly controls tar heating operations in column stills for the production of road tars; or for the refined distillation of light oil, to give benzol, toluol, solvent naphtha, etc., etc. In short, fractionating results hinge on temperature control.

Note the photo of the veteran Bristol installation. Bristol's Gas-Filled Recording Thermometers long have demonstrated their right to serve in such applications. All temperature ranges between 60° below zero and 1000° F. are dependably covered, and a uniformly graduated chart scale over the entire range is ensured. See Catalog No. 1303.

At the Sesquicentennial Exposition in Philadelphia

you are cordially invited to visit the representative display of Bristol's complete line of products.

BRISTOL'S:

the most extensive line of Recording Instruments including — Pressure, Liquid Level, Temperature, Electricity, Motion, Speed, Humidity, etc. Also Indicating Instruments, and a wide range of Temperature Control Equipment.

Ask for our catalog.

The Bristol Company, Waterbury, Connecticut

BOSTON NEW YORK PHILADELPHIA BIRMINGHAM PITTSBURGH
CHICAGO DETROIT ST. LOUIS SAN FRANCISCO

FOR 36 YEARS — Ask Any Technical Engineer — MAKERS OF

BRISTOL'S RECORDING INSTRUMENTS